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Electronics & Computing

MONTHLY

Britain's First Electronics & Computer Applications Magazine

TAKING THE LID OFF THE SPECTRUM

Z80 USING MENTA

DISTRIBUTION – ZX81

NASCOM MICRO-ED REVIEW

DIGITAL INPUT/OUTPUT FOR THE BBC MICRO

PROGRAMMING A HAND PRINT TERMINAL

COMPUTER AIDED DESIGN

PRINTERFACING THE ATOM

A JOURNEY TO THE STARS

Memory Expansion Service By Post

A 2K ZX81 is many more times more useful than the standard 1K as now approx. 1,100 characters of programme can be stored and still leave room for a full display. The installation of a 2K RAM chip involves the disassembly of the computer and some soldering (see E&CM Jan 82), as many owners do not feel confident to carry out this task — Bolton Electronics are offering to do this for them.

To avail of this service, simply send the computer to Bolton Electronics at the above address. The inclusive charge for this service is £14.95 which includes the 2K RAM chip, the necessary sockets etc., testing and the return postage.

Alternatively the parts and full instructions can be supplied for £10.35 inc. V.A.T. and postage.

School Software Competition

Transam Computers and Hutchinson Education announce a new microcomputer software competition aimed at primary and secondary school teachers. Prizes totalling £1,750 will be awarded to the first twelve winners with guaranteed publication of winning programs. Royalties will be paid to authors and all copyright fully respected.

Prime Programs is a joint venture of Transam and Hutchinson Education. One of its main objectives is to encourage the production of high quality educational software and, accordingly, high standards of programming, robustness and documentation will be looked for. Equally, the educational value of the programs will be a central consideration.

Entry forms giving full details are available from 'Prime Programs' 17 Conway Street, W1P 6JD. The closing date for the competition is 1st July 1982 and prize winners will be announced in Autumn 1982.

Prime Programs also hope to publish a book of listings of the 40 best programs submitted other than prize winners. This will be in addition to individual winning programs which will be published separately.

Where possible, all winning programs will be available to run on a variety of different microcomputers.

The competition is planned as an annual event.

It is hoped that primary schools will enter programs this year but Graham Clifton said 'We expect that substantially more primary schools will have microcomputers in 1983 and we are keen to include as many schools as possible.'

Further information is available from: Bob Osborne at Hutchinson Education 17 Conway Street, London W1P 6JD. (01-387 2811)

Graham Clifton at Transam Computers Ltd, 59-61 Theobald's Road, Holborn, London WC1. (01-405 5240/2113)

Acorn ADD-ONs

An E&CM reader is making available to other Acorn users a range of ready assembled peripherals The new equipment consists of a sound generator which is available with either 1,2 or 3 AY-3-8910 sound chips, built in amp and speaker and up to 6 eight bit I/O ports. There is also an 8 way joystick with 4 extra push buttons which plugs into one of the sound generators ports (up to six joysticks can be used simultaneously with the largest sound generator model) or into a joystick port adapter which uses the ports of the VIA in the ATOM. (The joystick port adapter can also be used as 2 general I/O ports with handshake) The joystick will also plug directly into the Technomatic ZX80/81 user port. A more powerful 5V 5A power supply is available with or without mains supression.

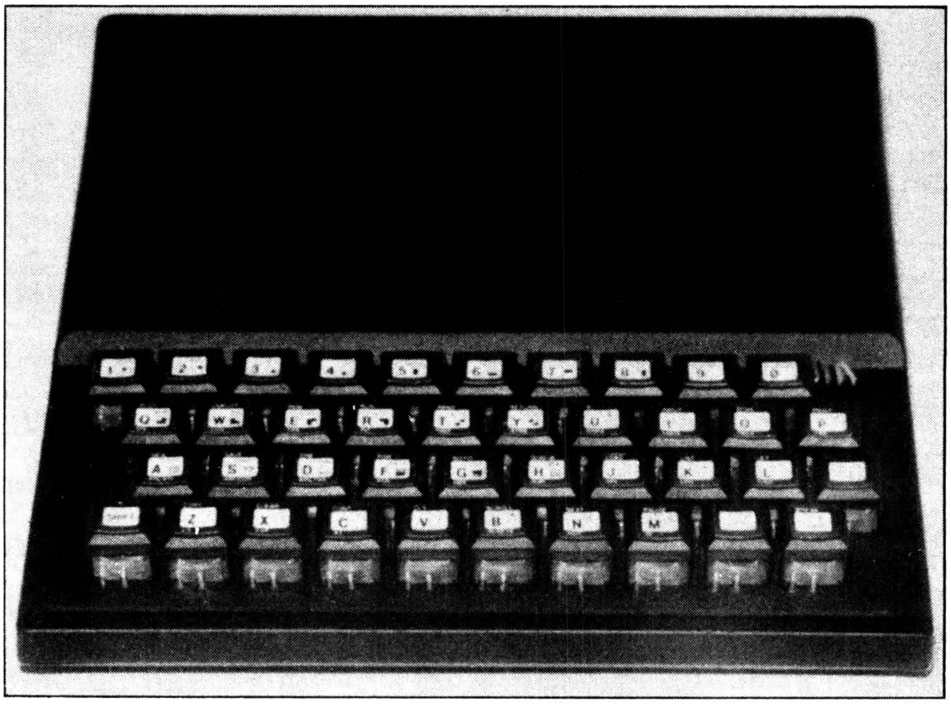
For more information send a SAE to: R Shillito, 5 Ingarfield Road, Holland, Clacton, Essex, CO15 5XA.

KEYBOARD FITS ONTO ZX81

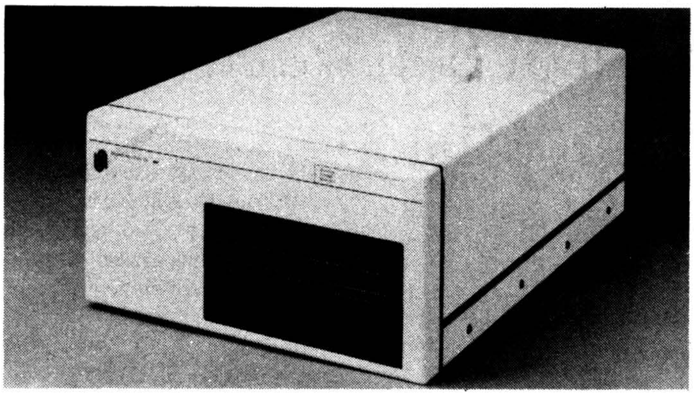
Kempston Electronics are launching a novel keyboard for the 81 which fits directly in place of the existing touch sentitive keypad.

The keys are mounted on a p.c.b., which is finished in the same colours as the ZX81. To attach the new keyboard the touch sensitive pad is simply peeled off and the new full size board is dropped into place. The p.c.b., is an exact fit and a ribbon cable is used to attach the keyboard to the ZX81.

The keyboard is sold as a kit and can be obtained directly from Kempston Electronics, 50 Adamson Court, Hillgrounds Road, Kempston, Bedford.



New Ethernet Development Tools



Thame Systems Limited the distributor for Ungermann-Bass has just released details of a new Network Configuration Facility (NCF-2). The system consists of a 5 Megabyte winchester disk housed together with a 1 Megabyte floppy diskette unit and intelligent controller having an IEEE 488 interface.

The NCF-2 is connected to Net/One by plugging into a 6412 application processor board which can be fitted into any Network Interface Unit (NIU2A).

By using a Whitesmiths C compiler it is possible to produce non-standard software modules for applications not covered by standard Net/One software.

The standard operating system used by the NCF-2 is CP/M and when not in use as a Network Development Tool the NCF-2 may be accessed by privileged users who can run standard CP/M based software packages.

Enhancements to Net/One software mean that diagnostic functions can be invoked from the NCF-2 even by remote telephone connection if desired.

At startup or when adding additional equipment to the network, the NCF-2 is used to provide the various programmes and Network Interface Unit definitions which are down-loaded into each N.I.U.

After receiving their programme load each N.I.U. is able to operate without further reference to the NCF-2.

The NCF-2 contains all the information required to restore the Network in the event of a complete power failure. It also provides security checks in the event of an illegal user attempting to connect to Net/One.

For further information contact Ron Davis, Thame Systems Limited, 084 421 5471.

DOS for Nascom Users

A complete disk operating system designed specifically for the Nascom 1,2 and 3 microcomputers has been introduced by Gemini Microcomputers Limited.

Called PolyDos, the system is fully compatible with existing software written for NAS-SYS 1 or 3, which means programs can be saved on disk without any changes. Installing PolyDos requires no hardware modifications; however the Nascom must have a minimum of 48K RAM and use either a GM8 15 floppy disk system with a Gemini GM8 09 floppy disk controller card, or a Gemini GM805 floppy disk system. Different PolyDos versions are available for the two systems.

Under PolyDos the GM815 disk system supports both double sided single density and double sided double density giving 175KB and 315KB total storage per drive, respectively. The GM805 system will support only single density format. Single density disks, however, are interchangeable between the two systems.

The PolyDos system includes a 4K Disk BASIC extension program, a disk-based editor and an assembler. An extension to the Nascom ROM BASIC, Disk BASIC will run existing BASIC programs without modification. The disk assembler, PolyZap, is probably the most advanced assembler ever written for the Nascom. Features include conditional assembly, multiple input files, and referencing of external symbol table files.

Three utility programs are supplied with PolyDos at no extra cost: SuperZap, FORMAT, and BACKUP. SuperZap allows editing of sectors on a disk. Sectors are displayed in hex and ASCII and, by moving the cursor, bytes to be modified can be selected. The program called FORMAT will format and verify disks. BACKUP allows the user to make back-up copies of disks, as well as enabling disks to be converted from single to double density format and vice versa.

PolyDos is supplied as a system disk and two 2708 EPROMS. The documentation is divided into five manuals: user's guide, system programmer's guide, editor manual, assembler manual, and Disk BASIC manual. The complete PolyDos package costs just £90 plus VAT and is available from any MicroValue dealer.

For further information contact David Neal at Media Marketing Services Ltd on 01-437 8146 or John Marshall at Gemini Microcomputers Ltd on (02403) 28321.

ZX99 Automatic Tape Drive Controller

Data-Assette are launching the first of their hardware add-ons for the ZX81, which slots into the expansion board still allowing use of the ZX Printer and 16K RAM pack.

The ZX99 is the logical extension to the ZX81, giving it real data-processing power. Business systems, word processing and information retrieval all now come within reach, making your ZX81 a fully fledged information handling system — and that's what computers are all about.

Under full software control, you can handle up to four tape recorders at once, (two for loading and two for saving), through their 'remote' sockets. The unit enables you to use tape storage to hold data files — not just programs — up to 200K bytes on a single cassette.

This is achieved through powerful USR commands in the ZX99's Tape operating system held in its own built in ROM. The recording format is totally matched to the ZX81, so there are no compatibility problems, you can even use the ZX99 to make directory listings of your ordinary program storage tapes. It also features a full tape to tape copy program evoked by a single USR command.

As if this were not enough, the ZX99 also provides you with a (RS232C) serial output interface, that allows you to drive one of the wide range of printers that accepts the standard ASCII data. (If you already own a ZX printer, the system is fully compatible).

With its combination of data storage and printer drive the ZX99 gives your ZX81 all the extra capabilities that it needs.

For further information contact:
Data-Assette,
44 Shorotan Street,
London NW1.

MicroValue Represent The Serious Computer User

Anyone serious about putting their computer to meaningful use will wish to expand the system and may well find their local computer store unable to assist for a variety of reasons.

A new idea launched by a group of independent computer shops is collaborating to provide customers with the benefits of the multiples, i.e., bulk purchase discounts and uniformity of product and, in addition, service. MicroValue is quite novel since it is neither a franchise network nor a single company. There are parallels to be drawn between MicroValue and, say, Photomarkets, which operates a similar basis.

The marketing strategy draws strength from numbers, however with MicroValue it goes further since each dealer undertakes to handle repairs and enquiries on advertised products irrespective from which MicroValue outlet they were purchased. This is no mean offer since the group decided to throw out the normal 90 day warranty on computer equipment and give a full 12 months warranty on all built systems and peripherals.

Dedicated Dealers

The refreshing aspect of MicroValue is that all the members are dedicated to furthering computing. That is not to say they don't sell other products, since many do, but computers are not in their shops because they are fashionable. They are there because the dealer believes in them and has grown up with them.

As testimony to this claim is the example shown by MicroValue dealers prior to the group's inception. The original dealers (there are a couple of recent additions) were all suppliers and devoted followers of Nascom Microcomputers. When that company ran into difficulties customers who had bought Nascom equipment with a view to expanding it faced an uncertain future. No-one knew that Lucas Logic would eventually buy Nascom Micocomputers, so there was, understandably a fair degree of despondency among dealers and users. Being one of the first truly British micro pioneers, Nascom had a considerable loyal following.

The original MiroValue dealers could have dumped this following and switched to other micros for there were many around at this time and, indeed, some of the dealers were already selling Sharps and other machines. Instead, they banded together and resolved to continue advertising as well as developing compatible expansion boards. From that resolution came the idea to pool advertising funds and adopt a common marketing policy. For several months, the joint advertisements appeared under a Nascom headline but as more and more of the dealers' own boards and software came on stream it became inappropriate to apply the Nascom name and a new umbrella title was sought.

New Name

The search ended with an agreement on the name MicroValue, which was promptly registered much to everyone's surprise that no-one else had thought of such an obvious name before. Although each member dealer adopted the name, they continued to maintain there own idenitities and independence but have remained loyal to the original concept of promoting and developing Nascom compatible products. This has now blossomed into a concerted effort to establish a British bus standard, known as 80-BUS, which encompasses not only Nascom products but also those of Gemini Microcomputers, — a British company which last year launched the MultiBoard system.

Modular Systems Approach

MultiBoard is a modular board system employing the 80-BUS for interconnection between modules. MultiBoards are available only through MicroValue dealers as are a number of other 80-BUS boards developed by the dealers themselves. Other British manufacturers such as Arfon Microelectronics, Winchester Technology, Quantum Computer Systems, Microde Process Control Systems, E V Computing (also a MicroValve dealer) and 10 Systems have added boards to bring the available range to over 20 and growing.

Because each dealer has total independence over its product range, although it must be able to offer products advertised, customers have access to a variety of equipment including other micros, especially Z80 based machines, and peripherals. There is, however, a high degree of peripheral and media continuity among dealers because of the advantages of bulk purchasing. Among recent additions to the MicroValue repertoire are the Gemini Galaxy-1 and Quantum 2000 CP/M disk based microcomputers. Both are built and tested systems using MultiBoard modules and, hence, the 80-BUS bus structure.

New 80-BUS boards include a powerful Z80 CPU board with 64K of on board dynamic RAM; IEEE 488 board; A/D conversion board; 32K Static RAM board; an intelligent colour board; and several others.

MicroValue Dealers

Bits & PCs
4 Westgate, Wetherby,
W. Yorks
Tel: (0937) 63774

Computer Interfacing & Equipment Ltd.
The Micro-Spares Shop,
19 Roseburn Terrace,
Edinburgh EH12 5NG
Tel: (031) 337 5611

ElectroValue Ltd
28 St Judes, Englefield Green,
Egham, Surrey TW20 0HB
Tel: (0784) 33603

E.V. Computing
700 Burnage Lane, Burnage,
Manchester M19 1NA
Tel: (061) 431 4866

Henrys Radio
404 Edgware Road, London
W2. Tel: (01) 402 6822

Interface Components Ltd
Oakfield Corner, Sycamore
Road, Amersham, Bucks.
Tel: (02403) 22307

Leeds Computer Centre
62 The Balcony, Merrion
Centre, Leeds.
Tel: (0532) 458877

Skytronics
2 North Road, The Park,
Nottingham.
Tel: (0602) 45053/54215

Target Electronics
16 Cherry Lane, Bristol
BS1 3NG
Tel: (0272) 421196.

Low-cost Big Memory Machine

Low-cost micro-system pioneer John Marshall, has developed a competitively priced micro-computer with an impressive specification.

Called "Galaxy-1" the computer has been built around the MultiBoard system — and established range of microboard modules developed by Gemini a year ago and in wide use by manufacturers of micro computer products.

The proven hardware includes twin Z80 microprocessors, 64K bytes of dynamic random access memory, two double density 5.25in floppy drives giving 400K storage per drive, and a detachable 59-key keyboard. The second microprocessor controls all video functions, thus freeing the entire 64K dynamic RAM for program execution.

Galaxy-1 is supplied with a comprehensive selection of software including the CP/M 2.2. disk operating system and COMAL-80 — a powerful extended BASIC from Denmark that features a number of the structures found in PASCAL. Gemini have also added a useful text editor and formatter called GEM-PEN, which offers a number of word processing facilities, GEM-ZAP — a Z80 editor/assembler, and GEM-DEBUG — a machine code debugging utility.

Provision for both parallel and serial printers via Centronics and RS232 interfaces is made. A 1200 baud CUTS cassette interface is included as well as a light-pen input. The specially designed 59-key Cherry keyboard is supplied in a separate housing and plugs straight into the Galaxy-1 main housing, as will the user's video monitor.

Galaxy-1 is available fully built and tested for just £1450 plus VAT. A full specification and list of stockists are available from *Gemini Microcomputers Ltd., Oakfield Corner, Sycamore Road, Amersham, Bucks. Tel: (02403) 28321.*

Galaxy-1 Specification.

Processors:		Twin ZX80A at 4MHZ (no wait states)
Memory:	Z80-1:	64K dynamic RAM 2K phantom ROM
	Z80-2:	2K monitor ROM 2K workspace RAM 2K screen RAM 2K character generator ROM 2K character generator RAM
Keyboard:		64 character input buffer Full ASCII encoding 59 keys 2-key rollover Caps lock function Cursor control keys
Video:		80 x 25 display format inverse video 160 x 75 pixel graphics programmable character set programmable special functions
Disk:		2 x 5.25in drives 400K storage per drive Double density
Serial I O:		RS232 interface Programmable baud rates Modem control signals 1200 baud CUTS cassette interface
Parallel I O:		Centronics parallel interface
Other I O:		Light pen input 1V P-to-P Video output
Software included:		CP M 2.2 Operating System COMAL-80 Structures BASIC GEM-PEN Text Editor Formatter GEM-ZAP Z80 Editor Assembler GEM-DEBUG De-bugging utility

BBC Micro-National Service Centre Set-Up

Production of the BBC Microcomputer is currently over 6,400 units per month. By the end of July both the existing subcontractors are estimating a combined output of over 12,000 units per month. A third sub-contractor has just been appointed who will produce a further 3,000 units per month. They will switch to the overseas markets when the backlog of sales has been reduced. At the moment production of the two machines is split 3 to 5 to the standard Model A and the enhanced Model B respectively.

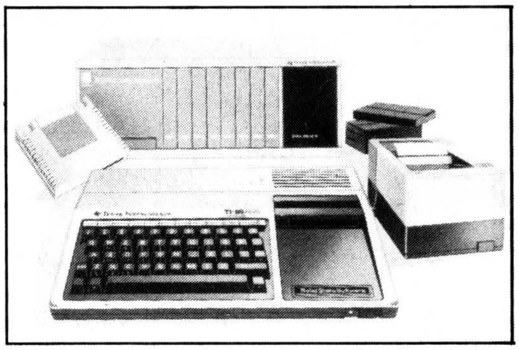
Model A computers are now delivered within 21 days of receipt of orders and a limited quantity are being shipped to dealers. Model B computers still have a backlog of some 12,000 units which at present demand will be cleared by the first week in August.

Services Centres

Seventy Acorn dealers have undertaken to provide after sales service and advice for the BBC Microcomputer. They are being equipped with automatic test/diagnostic systems and service manuals. They all recently attended a two day technical seminar in Cambridge recently.

An agreement has now been finalised with Retail Control Systems Ltd in Middlesex to provide a nationwide repair service for all parts of the system as a back-up to the dealer or to handle repairs now being dealt with by Acorn Computers via BL Marketing.

Retail Control Systems Ltd will also provide, at a very reasonable fee, maintenance contracts for all customers but in particular, those with substantial installations of BBC computers such as schools and colleges.



Dear Sirs,
In my business we use a Pet CBM 3032 with disk drive and a Printerm printer for a variety of duties including invoicing, costings, some analysis of production and data storage. With the exception of data storage (PETAID from Stage One) I wrote the programmes myself, all in Basic.

I now wish to move to a slightly more powerful system with CP/M and feel that Superbrain looks to offer value for money. However I have no experience at all of CP/M and as I shall be having the new system in my home where I can work without interruption we shall still retain the CBM. I note that Basic can be used on CP/M systems but am not sure exactly what this means. Can I, for example, write programmes in Basic on a Superbrain (if that is what I buy) in my home and then use the same programmes in my office on CBM machine. If the answer is no can you suggest an alternative CP/M machine where the answer would be yes. My point in wishing to go CP/M is to move into an area where software is readily available as I feel that CBM has not really made the move from hobby/home/school type machine into the business world whereas it seems that CP/M machines have.

My programming knowledge is limited, being self taught from books and experience. I would be most grateful for any suggestions you are able to offer. The price area I have in mind is around the £3000 mark (perhaps a little more) to cover a complete system including drives and a reasonably good quality printer, not necessarily including any software although it would be nice to have a database programme and a wordprocessing programme within the price if it should prove possible.

I look forward to your advice either by letter or printed in the magazine.

Yours faithfully,
D.E. Higgins.

Dear Sir,
I enjoyed Reg Boor's "Technical Graph Plotting with the ZX81" in the March 1982 issue, and if the listings shown in Figures 1,2,3, & 4 are examples of the ZX81 printer then it speaks well for the device, I must get one. However, I can't agree that Fig. 4 was a print-out of the listing shown below the graph. Line 340 should read "FOR X = 1/(2*SX) TO 1.25 STEP 1/(5*SX)". At least, that line works better on my ZX81 than the line given in the article.

Peter Grinstead,
Pennance Road,
Falmouth.

Dear Sir,
I was interested in your article on BBC interfacing in the May issue of Electronics and Computing and am responding to your invitation to suggest topics for further articles.

What interests me and, I suspect, many other readers is robotics and hence articles on hardware details of interfacing stepper motors and associated equipment together with the software controls would be immensely useful.

Your Sincerely,
Jon Greenman.

Dear Sir,
I wonder if any of your readers can help with a ZX81 problem? I have noticed that when the computer is switched on there is background interference with stereophonic radio reception — a kind of "chortling" noise. Even if the radio is connected to an external VHF aerial (not a TV aerial) and at the opposite end of the house the interference still persists. It sounds as if the computer is producing electrical discharges which are picked up directly by the radio independently of the aerial.

I feel sure that there must be some method of suppressing these unwanted noises but no one I have spoken to so far has been able to suggest one. Does anyone have any ideas?

Brian Bagot
Woodlands Close,
Cranleigh,
Surrey.

Dear Sir,
I was interested to read your article "Interfacing the B.B.C. Microcomputer" in the May issue of Electronics & Computing. With regard to future articles I would be particularly interested in applications in the Physics Laboratory e.g. data logging and analysis.

As you may know Lincolnshire County Council have bought **every** secondary school a B.B.C. micro. The County Advisor for Microelectronics has organised a series of in-service courses to run shortly on which I am lecturing on control/electronics aspects. In connection with this I have designed and prototyped a general purpose interface box with 4 dedicated input lines and 4 dedicated output lines all protected by optical isolators. The output lines can switch 180 ohm, 60 ma relays. The box is also protected with zener diodes and short circuit protection devices. If you would like further details (circuit diagram, p.c.b. pattern) I would be pleased toi supply them.

Finally if you have details of the operating system machine code calls I would appreciate a copy.

Dr. J. Marsden,
Wragby Road,
Lincoln.

PROGRAMMING A HAND PRINT TERMINAL

The commonest form of human interaction with a computer system is via the use of some form of keypad or keyboard. Devices of this type can be used to facilitate the input of individual alphanumeric characters - as might be used in a simple menu selection procedure. A more useful mode of operation, however, is that which enables a collection of consecutive characters to be typed - thereby enabling the input of a message string.

by Philip G Barker

Such strings may be used to command the computer to perform one of its many electronic data processing, computational or control functions. Thus, the message strings: ADD 3+2, SORT JACK, EDIT MARY, and SWOFF 295 may be used to initiate numeric addition, file sorting, file editing, and, control switching operations, respectively.

If the keyboard device is associated with a CRT screen then more sophisticated types of input transaction can be implemented. For example, through the use of suitable keyboard control keys it is usually possible for the user to move a screen cursor and locate it within any of the available screen character positions. Typically, these constitute a matrix of 24 rows by 80 columns — making a total of 1920 positions in all. Given that the user's terminal is reasonably intelligent it is always possible to determine the position at which the cursor resides. A facility of this sort gives an added dimension to the user's input capability. Now, in addition to specifying a message string, the user can control the physical location at which this will be positioned on the screen. In many situations this may have special significance since the location of a message on the CRT surface may determine its semantics or meaning. Suppose, for example, that the string being typed is positioned at row 12, column 20; the control software resident within the terminal might now be programmed to accept and validate this as a SURNAME value. Similarly, should the cursor be positioned at row 18, column 30, then, this may be taken to indicate that an AGE value is being typed. From these examples it is easy to see that the position of the cursor helps to determine the meaning of the data being entered.

A hand print terminal works in an analogous fashion to the screen/keyboard system outlined above. However, instead of typing and positioning a cursor the user prints message strings on a specially designed data capture document. This is positioned above a pressure sensitive surface in such a way that the terminal hardware is able to deduce both the nature of the characters being written and their position on the surface.

A typical arrangement for such a system is illustrated in figure 1. The data capture document that is shown here allows the input of four items of data: a person's name, his/her age, sex and salary. In order to give instructions to the user the terminal is equipped with a single (40 character) line display. The diagram shows this being used to prompt the user to enter appropriate salary data. This would now be achieved by printing a string of decimal digits within the five vacant boxes next to the salary keyword on the document.

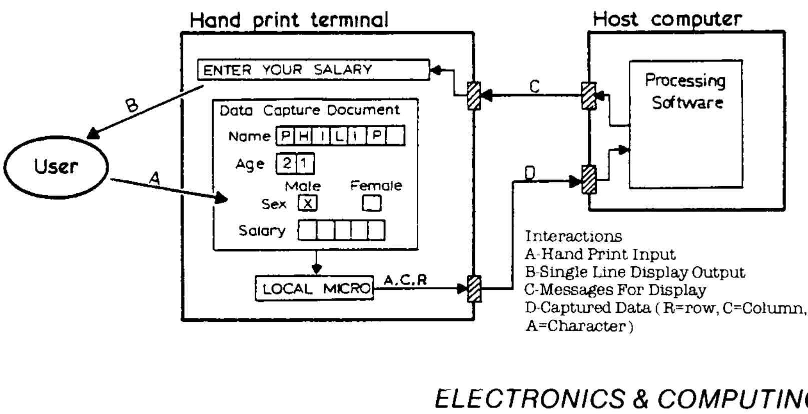
The pressure sensitive surface may be regarded as being subdivided into a grid of small squares, each side being of length 0.25 inch. Individual squares are identified by their column and row numbers. Embedded within the terminal is a microcomputer system. This is responsible for character recognition and position determination. Thus, when the user writes a character on the data capture document the row number (R), column number (C), and ASCII value (A) of the symbol written are each determined. This information is then made available to the host computer to which the terminal is attached. The software in the host now has to analyse this triplet of values and decide what to do with them.

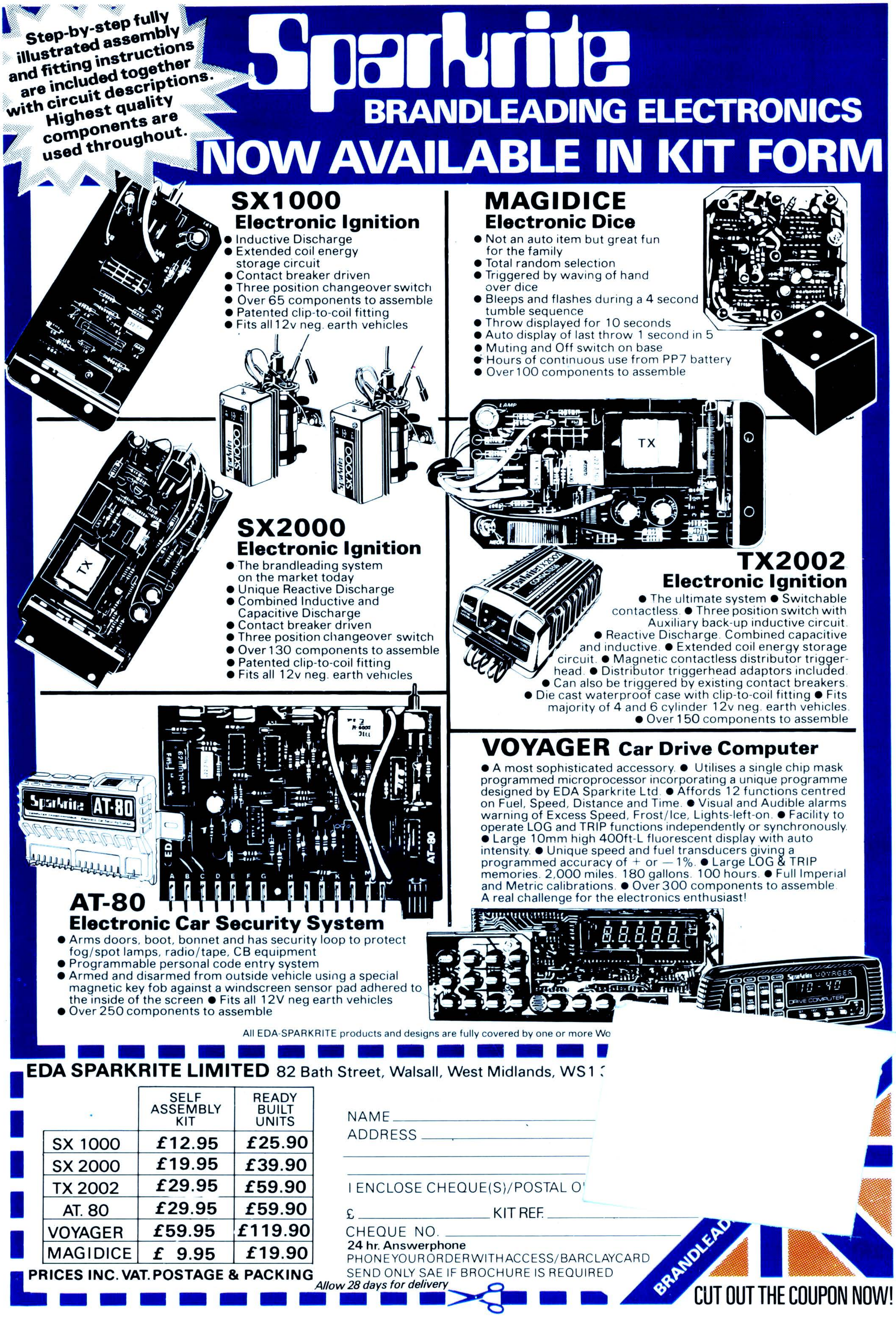
MECHANISM OF OPERATION

There are several different approaches to the design and construction of intelligent devices capable of recognising hand printed text. One of the simplest of these measuring the resistance, in two dimensions, across a specially prepared conducting sheet. The principle of the method is illustrated in figure 2. Sketch (A) shows a cross section of a pressure sensitive pad that operates on this principle. Two conducting membranes are held parallel to each other by stretching them over an insulated rectangular frame (shown shaded). Data capture documents are placed on the upper of the two conducting surfaces. When a user writes on this document, the pressure of the pencil stroke forces the two membranes into contact thereby completing an electrical circuit — as shown in sketch (B). By accurately measuring the resistance in the X and Y directions — see sketch (C) — it is possible to determine the absolute coordinates of the point of contact of the writing instrument. These can easily be converted into row and column numbers within the matrix grid system described above.

In addition to calculating the grid coordinates at which information is being written the hardware in the terminal must attempt to deduce which characters the user is scribing on the surface of the document. Various mechanisms exist for doing this; most of them depend upon some form of pattern recognition procedure. Two of these techniques are briefly outlined below.

FIGURE 1. Data Entry Via A Hand Print Terminal.





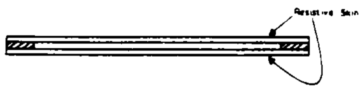
Step-by-step fully illustrated assembly and fitting instructions are included together with circuit descriptions. Highest quality components are used throughout.
Sparkrite
BRANDLEADING ELECTRONICS
NOW AVAILABLE IN KIT FORM
SX1000
Electronic Ignition
● Inductive Discharge
● Extended coil energy storage circuit
● Contact breaker driven
● Three position changeover switch
● Over 65 components to assemble
● Patented clip-to-coil fitting
● Fits all 12v neg. earth vehicles
MAGIDICE
Electronic Dice
● Not an auto item but great fun for the family
● Total random selection
● Triggered by waving of hand over dice
● Bleeps and flashes during a 4 second tumble sequence
● Throw displayed for 10 seconds
● Auto display of last throw 1 second in 5
● Muting and Off switch on base
● Hours of continuous use from PP7 battery
● Over 100 components to assemble
SX2000
Electronic Ignition
● The brandleading system on the market today
● Unique Reactive Discharge
● Combined Inductive and Capacitive Discharge
● Contact breaker driven
● Three position changeover switch
● Over 130 components to assemble
● Patented clip-to-coil fitting
● Fits all 12v neg. earth vehicles
TX2002
Electronic Ignition
● The ultimate system ● Switchable contactless. ● Three position switch with Auxiliary back-up inductive circuit. ● Reactive Discharge. Combined capacitive and inductive. ● Extended coil energy storage circuit. ● Magnetic contactless distributor trigger-head. ● Distributor triggerhead adaptors included. ● Can also be triggered by existing contact breakers. ● Die cast waterproof case with clip-to-coil fitting ● Fits majority of 4 and 6 cylinder 12v neg. earth vehicles. ● Over 150 components to assemble
VOYAGER Car Drive Computer
● A most sophisticated accessory. ● Utilises a single chip mask programmed microprocessor incorporating a unique programme designed by EDA Sparkrite Ltd. ● Affords 12 functions centred on Fuel, Speed, Distance and Time. ● Visual and Audible alarms warning of Excess Speed, Frost/Ice, Lights-left-on. ● Facility to operate LOG and TRIP functions independently or synchronously. ● Large 10mm high 400ft-L fluorescent display with auto intensity. ● Unique speed and fuel transducers giving a programmed accuracy of + or − 1%. ● Large LOG & TRIP memories. 2,000 miles. 180 gallons. 100 hours. ● Full Imperial and Metric calibrations. ● Over 300 components to assemble. A real challenge for the electronics enthusiast!
AT-80
Electronic Car Security System
● Arms doors, boot, bonnet and has security loop to protect fog/spot lamps, radio/tape, CB equipment
● Programmable personal code entry system
● Armed and disarmed from outside vehicle using a special magnetic key fob against a windscreen sensor pad adhered to the inside of the screen ● Fits all 12V neg earth vehicles
● Over 250 components to assemble
All EDA-SPARKRITE products and designs are fully covered by one or more Wo
EDA SPARKRITE LIMITED 82 Bath Street, Walsall, West Midlands, WS1
	SELF ASSEMBLY KIT	READY BUILT UNITS
SX 1000	£12.95	£25.90
SX 2000	£19.95	£39.90
TX 2002	£29.95	£59.90
AT. 80	£29.95	£59.90
VOYAGER	£59.95	£119.90
MAGIDICE	£ 9.95	£19.90
PRICES INC. VAT. POSTAGE & PACKING
NAME
ADDRESS
I ENCLOSE CHEQUE(S)/POSTAL O
£ KIT REF.
CHEQUE NO.
24 hr. Answerphone
PHONE YOUR ORDER WITH ACCESS/BARCLAYCARD
SEND ONLY SAE IF BROCHURE IS REQUIRED
Allow 28 days for delivery
BRANDLEAD
CUT OUT THE COUPON NOW!

The simplest approach to character recognition depends upon converting the dynamic positions of the pen on the document into a stroking pattern. Some examples of these, for the letters A, M, and Z, are shown in sketch (D) of figure 2. Each letter of the alphabet will have a characteristic set of patterns. The number of these that will be recognised (for a given letter) will vary from one terminal to another and will depend upon the degree of flexibility that is built into the system. The easiest way to store the allowed stroking patterns is within Read Only Memory as a series of vectors representing direction values. Thus, the letter A might be stored as a three element vector [d1, d2, d3]; the letter M would be stored as **[d4, d2, d1, d5]** while Z would be stored as [d3, d6, d3, d3]. When a character is written on the data capture document its stroking pattern is determined and this is then compared with the pre-defined values stored in the terminal's ROM.

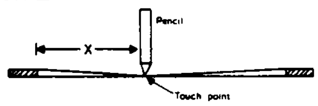
An alternative method of character recognition depends upon building electronic hardware that is able to determine, for any given letter, the number of obliques, horizontals, verticals, loose-ends and curves from which it is constructed. Again, each character has a characteristic pattern — as can be seen from the table shown in figure 3. Thus, the letter A is composed of 2 obliques, 1 horizontal, 2 loose-ends, no verticals and no curves. Similarly, the letter B has 1 vertical, 2 curves, no obliques, no horizontals and no loose-ends.

FIGURE 2 Hand Print Terminal-Principles of Operation

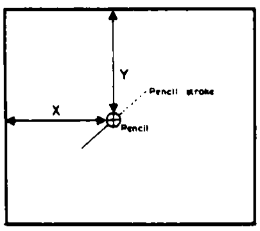
Sketch A



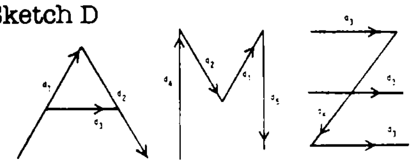
Sketch B



Sketch C



Sketch D

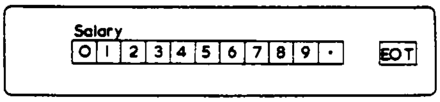


Once the information embodied in the table contained in figure 3 is committed to ROM, character recognition becomes a simple matter. As characters are written on the data capture document, their five defining parameters are ascertained. These values are then compared (via pattern matching techniques) with those held in the read only memory. A successful match then enables the character value to be determined. Of course, should the pattern matching fail an appropriate code must be sent to the host computer to indicate that recognition has been unsuccessful. Should this happen the user would normally be given the opportunity to re-enter the mis-recognised character.

Figure 4 Transaction Types

(A) Single Peck

(B) Multiple Peck



(C) Character Stroking

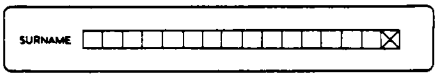


FIGURE 3 Character Recognition Via Pattern Matching

Letter	Obliques	Verticals	Horizontals	Curves	Loose-ends
A	2	0	1	0	2
B	0	1	0	2	0
C	0	0	0	1	2
D	0	1	0	1	0
E	0	1	3	0	3
F	0	1	2	0	3
G	0	0	1	1	3
H	0	2	1	0	4
I	0	1	2	0	4
J	0	0	1	1	3
K	2	1	0	0	4
L	0	1	1	0	2
M	2	2	0	0	2
N	1	2	0	0	2
O	0	0	0	1	0
P	0	1	0	1	1
Q	1	0	0	1	2
R	1	1	0	1	2
S	0	0	0	1	2
T	0	1	1	0	3
U	0	2	0	1	2
V	2	0	0	0	2
W	4	0	0	0	2
X	2	0	0	0	4
Y	2	1	0	0	3
Z	1	0	2	0	2

NOTE: C and S would be resolved on the basis of the number of anticlockwise to clockwise transitions that take place during letter formation.

(D) Peck & Ring

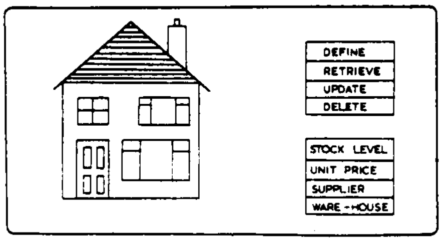
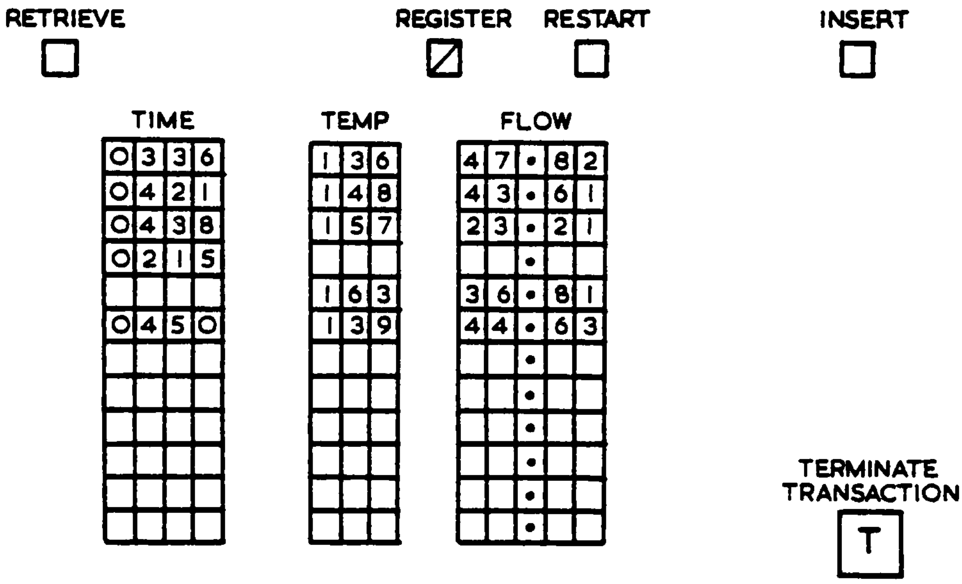


Figure 5 Data Entry & Retrieval Document Performing Log for Naptha Feed Pump No 417A



(B) Use of a Touch Table

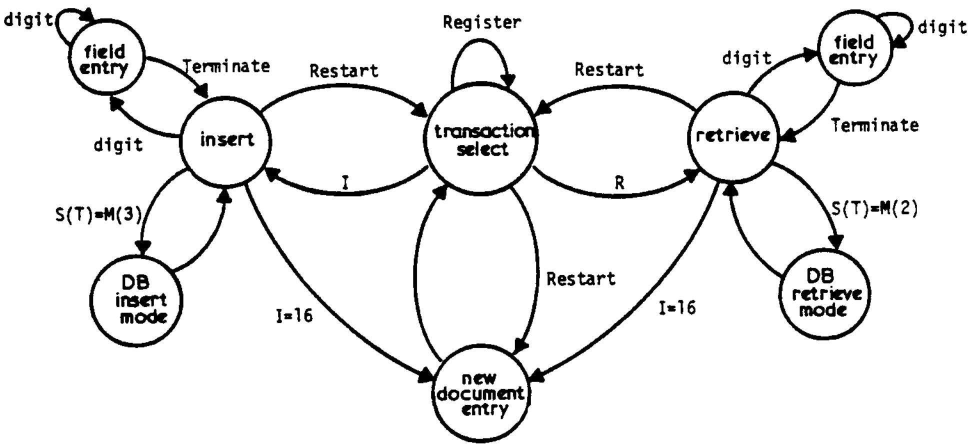
FIELD	ROW	COLUMN	TRANSACTION TYPE	ENTRY ORDER	DATA TYPE
Retrieve	1	3	Single Peck	2	Peck
Register	1	16	Stroke	1	Stroke
Restart	1	21	Single Peck	2	Peck
Insert	1	30	Single Peck	2	Peck
Time	4-15	5-8	Character Stroke	3 or ?	Numeric
Temp	4-15	12-14	Character Stroke	4 or ?	Numeric
Flow	4-15	17-18 20-21	Character Stroke	5 or ?	Numeric
Terminate	15-16	30-31	Single Peck	?	Peck

TYPES OF TRANSACTION

We have established that the pressure sensitive surface upon which the user writes may be regarded as a matrix of squares. The hardware built into the terminal then provides the host computer with both position and value data. When designing data capture documents for use with a hand print terminal it is thus feasible to define input strategies that depend upon either or both of these types of data values. Thus, it is extremely easy to implement a 1-of-N menu selection based upon position data alone. Similarly, string values can be input by repetitive application of this 1-of-N selection procedure. In general, the different kinds of input transactions used with the hand print terminal fall into four broad categories:

(a) Single Peck
(b) Multiple Peck
(c) Character Stroking
(d) Peck and Ring

Figure 6 Software Development Aids
(A) Use of State-Transistor Graphs



Each of these are illustrated schematically in figure 4.

The top of the diagram (case A) shows a three option horizontal menu. A document that utilises this type of menu would facilitate data entry by allowing the user to touch (or 'peck') the relevant option box with a pen or pencil. The coordinates of the point of contact could then be converted (by software in the host computer) into an appropriate information value.

Similarly, in case B, the twelve element horizontal menu allows numeric strings of digits to be entered by simply touching, in succession, the option boxes appropriate to the value that is to be input. The end-of-transaction box (EOT) is provided in order to facilitate the entry of variable length strings of digits.

In case C, the person entering the data would print alphabetic characters in the vacant boxes that are located to the right of the SURNAME keyword. If need be, the user can perform real time error correction by over-printing in boxes corresponding to characters that have been mis-recognised. When entry of the data value is complete (and correct) the user simply packs the box containing the X-symbol.

The peck and ring transaction (case D) allows the user to define various items in documents containing pictorial information. Thus, in the example shown, the user might peck the DEFINE segment within the vertical menu located on the right-hand side of the document. This puts the system into object definition mode. Next, the user touches the sub-component of the picture that is to be defined (say, the first floor left-hand window). This is then 'ringed around' to define the physical area of the document that the item occupies. Data values associated with this item may now be entered into the computer system via an appropriate keyboard dialogue. This data might include part-number, stock level, unit cost, supplier, reorder level and so on. Once definition is complete, subsequent pecks of the pre-defined areas of the document may be used to retrieve and modify previously entered data values. The peck and ring transaction is one of the more advanced types of interaction modes and will not be discussed further. Instead, we concentrate on simple peck and character stroking transactions.

The remaining section of this paper describes a simple case study that is designed to illustrate the techniques of software development for a hand print terminal. Only two of the four basic transaction types are employed for data entry.

THE CASE STUDY

The entry of information into a data base and subsequent retrieval of values from it are nowadays two commonly employed operations. In the case study described here, we show how these operations may be implemented by printing decimal digits at appropriate points on a specially designed data capture document similar to that shown in figure 5. Such a document would permit a machine operator to record the running conditions (temperature and flow rate) of an electrical pump as a function of time. This is achieved by filling in successive vacant rows of boxes in each of the three tables labelled TIME, TEMP and FLOW. Inspection of figure 5 reveals that certain of the rows contain data values while others remain yet to be filled. The next set of data would be entered into the sequence of boxes that constitute the seventh row of each of the tables.

As well as entering data into the system for storage the operator may wish to interrogate the past history of the machine's performance. This may be achieved by retrieving and examining previously entered data. Two types of retrieval request could be made: single key and double key. The first of these would require the terminal operator to enter a value for any one of the three possible search keys (time, temperature or flow). The system would then respond by supplying the values of the remaining two unknown process variables. Thus, when in retrieval mode, entry of a value in the temperature table would cause the software in the host computer to find the time and flow values corresponding to the given machine running temperature. Similarly, if two search key values are entered (there are three possible combinations) then the software would determine the unknown value of the third variable. For example, entry of a temperature and a flow value would cause the software in the host to retrieve the time at which those machine conditions were observed and recorded.

Inspection of the data capture document shown in figure 5 will reveal that there are three distinct areas used by the terminal operator. At the top there is a horizontal menu containing four option boxes. Beneath this are the three vertical tables used for the entry of data values; these permit up to twelve transactions to be performed before the document has to be replaced by a new one. The third area, the Terminate Transaction or T-box, is used to indicate the successful completion of the entry of individual numeric data fields.

The procedure for using the document and hand print terminal would be as follows. The host computer would prompt the user (via the terminal's display) to position the data capture document on the pressure sensitive surface. This would then be registered by 'ticking' the REGISTER box. Document registration allows the built-in microcomputer to compute correction factors that compensate for any misalignment of the document. Once registered, the user can select a transaction type by touching either the RETRIEVE box or the INSERT box. The selected transaction type then prevails until one or other of two conditions arise. If, at any time, the user pecks the RESTART box then the system immediately reverts to 'command' mode. This then allows the selection of an alternative transaction. A similar thing happens, automatically, when the data capture document becomes full and has to be replaced by another.

Suppose a new document has been placed on the terminal's writing surface and that the system is in transaction selection mode. It is required to enter some machine status data into the computer storage system. The operator pecks the INSERT box thereby selecting data insertion mode. A time value (0336) is then written in the fiorst row of the left-most table and the T-box then touched. Next, a temperature value (136) is printed in the central table and the T-box pecked again. Finally, the flow value (4782 — there is an implied decimal point) is written in the right-most table and the T-box pecked once more. As soon as

Continued on Page 67.

FIGURE 7 DATA CAPTURE ALGORITHMS

```
1.    Print "Enter Document";
2.    Wait(10);
      Getchar(R,C,A);
      If R=1 and C=16 then goto 3;
      Goto 1;
3.    Print "Please Register Document";
      Getchar(R,C,A);
      If R=1 and C=16 and (A="/" or A=" " then goto 4;
      Goto 3;
4.    Print "Document Registered OK";
      I=4;
      Wait(10);
5.    Print "Enter Transaction Type";
6.    Getchar(R,C,A);
      If R=1 and C=3 then goto 8; (*retrieve operation*)
      If R=1 and C=30 then goto 7; (*insert operation*)
      If R=1 and C=21 then goto 1; (*restart operation*)
      Goto 6;
7.    Print "Enter TIME Value";
7.1   Getchar(R,C,A);
      If R=1 and C=21 then goto 5; (*restart operation*)
      If R=I then goto 7.2;
      If C isin [5..8] and A isin [0..9]
        then begin;
          Update time value;
          Update display;
          Goto 7.1;
        end;
        else goto 7.1;
7.2   If R isin [15..16] and C isin [30..31]
        then begin;
              Enter time value into data base buffer;
              Goto 7.3;
            end;
        else goto 7.1;
7.3   Print "Enter TEMP Value";
      Getchar(R,C,A);
        o
        o
        o
        etc.
7.5   Print "Enter FLOW Value";
      Getchar(R,C,A);
        o
        o
        o
        etc.
7.7   Update data base system;
      Increment I;
      If I > 15 then begin;
           I=4;
           Print "Enter New Document";
           Goto 2;
        end;
       else goto 7;
8.0   Print "Enter Retrieval Request";
      Temp=null; Timne=null; Flow=null; Count=0;
8.1   Getchar(R,C,A);
      If R=1 and C=21 then goto 5;
      If R isin [15..16] and C isin [30..31] and Count=1
        then begin;
             Count=0;
             Enter Data Base Retrieve mode;
             Increment I;
             If I > 15 then begin;
                I=4;
                Print "Enter New Document";
                Goto 2; end;
             else goto 8.0;
        end;
      If R=I then goto 8.1;
      If C isin [5..8] and A isin [0..9] and time=null
        then enter time-field routine; (*Step 8.2*)
        else if C isin [12..14] and A isin [0..9]
        and temp=null
          then enter temp-field routine; (*Step 8.3*)
          else if (C isin [17..18] or C isin [20..21])
          and A isin [0..9] and flow=null
            then enter field-flow routine; (*Step 8.4*)
            else goto 8.1;
      If restart then goto 5;
      If count=1 then goto 8.1
          else begin;
            Count=0;
            Enter Data Base Retrieve mode;
            Increment I;
            If I > 15 then begin;
               I=4;
               Print "Enter New Document";
               Goto 2;
              end;
          else goto 8.0;
        end;
8.2   Time-Field Routine;
8.21  Update time value;
      Display time value;
8.22  Getchar(R,C,A);
      If R=1 and C=21
        then begin;
             Time=null; Temp=null; Flow=null;
             Restart=true;
             Exit;
          end;
      If R isin [15..16] and C isin [30..31]
        then begin;
             Enter time value into data base buffer;
             Increment Count;
             Exit;
          end;
      If R isin [5..8] and A isin [0..9] and C=I
        then goto 8.21;
        else goto 8.22;
8.3   Temp-Field Routine;
          etc.
8.4   Flow-Field Routine;
          etc.
```

Taking The Lid the SPECTRUM

by Guy Kewney

"We have thought seriously about calling this machine NOT THE BBC COMPUTER", said Clive Sinclair when he announced the Spectrum. It was generally taken as an example of Clive Sinclair's dry wit at the time; but I think he meant it.

In many respects, it's a shame he said it, and it's a shame that Sinclair has let the BBCF computer get so far under his skin, because I don't feel the comparison is relevant. Neither is it as favourable to Sinclair as his publicity machine says.

My opinion of what the Spectrum is can be summed up like this: "Sinclair has taken the incredibly successful design of the ZX81, and has improved it beyond all recognition. He has overcome every reservation which everybody has ever had about that machine — its rather dodgy cassette tape interface, its unfriendly flat keyboard, its very difficult machine code interface, and its low-quality black-and-white display — and has not only 'got it right' but has turned them all into assets. And he has (probably) struck an ideal balance between what the ZX81 users can afford, and what extras they are prepared to pay extra for. But the machine is one of the slowest on the market. And anybody who has got the money for the BBC micro is letting himself in for some envious moments if he opts for the Spectrum instead, because the gap in price reflects a real gap in features".

The beauty of the ZX81 was that it was cheap. It was the cheapest "real" computer in the world, and with it, hundreds of thousands of people have taken the plunge and found: "Gracious! I can understand programming!" And they've done it without risking their total spare money budget.

The Spectrum is not as cheap — by now, surely everybody knows that we pay £125 for a Spectrum with 16 Kbytes of operating software and 16 Kbytes of user memory. By contrast, a ZX81 with 16 Kbytes of user memory now costs £100, because the add-on memory pack price has been cut.

Sinclair thinks that there are still enough people around who can't afford more than the £60 which it costs to get a ZX81 (if you know where to buy) that he can carry on making the beast. But he also thinks that enough of them have decided that they need the extra 16 K rampack, to make them take a £125 computer with extra features, seriously.

So: what are these "extra features" that we have to judge worth the extra £25?

Machine Summary

The first, unfortunately, is one we have to take on trust. Unfortunately, because it is undoubtedly the most important — a direct access storage device for £50 — the thing called the Microdrive.

The second is an enhanced Basic language. It still omits the one thing which I think essential in such a machine, and that is easy access to machine code, but for all its faults, Basic is useable, and widely known. "Better", here, risks becoming the enemy of "good" (as Adam Osborne always tells me when I suggest possible improvements to something) and obviously Basic is good enough to use. Especially with new features.

The third is colour and programmable graphics.

Fourth, a respectable keyboard. Not a good keyboard, and with its faults, but at least you can use it without wondering if your finger has slipped off the key.

Fifth, sound generation. There is a silly design fault here, and it is one which I can't forgive — the sound is inaudibly soft, and it takes a tedious performance of plugging and unplugging to amplify it.

Sixth, an operating system. We never had one on the ZX81, and sadly we missed it, too. We get screen handling, tape handling, terminals handling, and network handling where previously we only had program save and load.

Seventh, we have auto-repeat on keys. Perhaps I should have put this first — it's something I'd pay extra £25 for, on the ZX81, without asking any more questions beyond "who do I make the cheque out to?"

And of course, there are a bag-full of other little things. Words Can have small (lower-case) letters as well as capitals. You can time things. You can write your own Basic commands. You don't have to plug the add-on memory pack on. There is a network. And a lot more.

Okay, we are probably on the point of losing our fellow-readers who don't have a ZX81, and don't know what it does.

The Spectrum in context

The first thing which a prospective buyer would notice about the Sinclair (any Sinclair) if they took one home for a week, is that there is only one thing to learn. On all other computers, you have to learn the language, and if you are not already familiar with typewriters, you have to learn the keyboard. On this machine, the language is the keyboard.

off

In other words, instead of typing PRINT, you press the P key, and the machine types PRINT for you.

It sounds wonderful, until you realise that there are around 90 different words in the Basic language. There are 40 keys on the Sinclair keyboard, and they also have to carry the numbers 0 to 9, the letters A to Z, all the punctuation, calculation, and editing functions, plus colour codes. At that point, only the fact that you have spent all your money on the machine persuades you to stick at it, and learn the way round the keyboard.

But the advantages go deep, for all their apparent elusiveness. On a Sinclair, you are never suddenly stuck for a command, and have to page through the manual to find it and how to spell it (and how many brackets (not forgetting how many layers of bracket (assuming you only use one form of bracket))) because it's there in front of you. Nine times out of ten, if you do use the command incorrectly, the machine will show you exactly where you have gone wrong.

To illustrate what I mean: on the Acorn BBCmicro, it is possible to put spaces into Basic statements where spaces should not be. PRINT TAB 20 should move you 20 spaces along the line on the screen. But it must not have a space between TAB and 20, or the machine thinks TAB is the label of some specified number (a variable) and hunts through the list of variables before stopping the program with a terse message to say that there is no such variable.

It can take a very long time before you realise that a space is causing your problem. And this is exactly the sort of frustrating thing which the Sinclair design prevents.

The drawback of the system can be seen from a glance at the keys with numbers 2, 3, 4, 5, 6, and 7 on them. Each key has six different possible meanings, and you can search for the one you need for minutes at a time before you find it.

Fortunately for Sinclair, he doesn't have to argue about the fact that users find this acceptable. His ZX81 sales have proved it — at least for a rock-bottom price machine.

The other thing about the Sinclair which newcomers need to be told, is the editor.

Basic as a language has one enormous advantage over anything that came before, and that is its ability to sort a program into order, no matter what order you write it. As long as the line number is right, the machine editor will put it in the right place.

However things have moved on since Basic was invented, and a lot of people who write Basic editors have failed to realise this.

For a start, we no longer talk to computers by typing on a Teletype, with paper in it. Computers today have video displays. Originally, video displays were designed to behave as though they were paper in a printing device — they were known as "glass Teletypes" — so that the software which ran on the computer would continue to run when a glass TTY was connected. That is, the letters that the user typed appeared on the screen one by one, as if an invisible key was hitting it. And after typing a letter, the market or "cursor" which showed where the next letter would be typed, moved to the right, as if a print head had moved across the paper.

And, naturally, once you had written a whole line, the paper moved up. It was gone, dirty, covered in ink. Even if it wasn't actually there. Even if it was really a character generated by having the computer look at an area of memory, and display the characters it found there.

Basic programs fit into memory. It is quite easy to have the computer look through the area of memory in which it has stored the Basic program characters, and show what is there.

But because, long ago, people pretended that there was a bit of paper in a teleprinter, Basic doesn't normally look at an area of memory. Instead, it digs out a few lines from that area of memory (the program area) and moves them into another area (the display memory) where they are shown on the screen. If you want to look at the next line of Basic, it gets printed at the bottom of the paper. If you want to look at the previous line, you have to erase the whole video memory, and go back to the program area, and dig out a previous line, and re-write that into the video memory. Just as if you were printing a new page.

Sinclair's Basic doesn't do anything so potty. If you have LISTed lines 400 to 500, and realise that you want to see line 390, you just move the cursor up. Line 500 probably slips off the bottom of the screen, and line 390 appears at the top.

If you type line 30. then line 50, then line 10, then line 60, then line 20, then line 40, then line 10 again, most Basic machines would show you a "listing" like this:

```
30 REM THIRD LINE
50 REM FIFTH LINE
10 REM FIRST LINE
60 REM SIXTH LINE
20 REM SECOND LINE
40 REM FOURTH LINE
10 REM NEW FIRST LINE
```

which you're welcome to try to understand. To clarify things, you type LIST, and get the whole program, correctly ordered. But if the screen has room for 20 lines, and the program is 300 lines long, it all flashes by, and you end up with just the last 20. Sinclair Basic would always have them in order, at the top of the screen. And after it had LISTed the first 20 lines, it would stop, and ask you if you wanted more: "Scroll?" it asks politely.

The machine in detail 1 The Microdrive

This is almost certainly a floppy disc. The word "almost" goes in because as recently as April, people close to Sinclair were still unsure whether has new diskette design woul be picked in preference to a very fast tape cartridge. Note — cartridge, not cassette. A cartridge, normally, is much faster and more controllable than a music compact cassette. It can move forward, back, fast and slow, under machine control. At best, the compact cassette can stop and start when the computer turns it off and on. Now, Clive says that it will be a diskette, and he is obviously counting heavily on that device to put him ahead of any competition. But that doesn't mean that he's giving anything away about it.

Apart from the fact that it will work with commands SAVE, VERIFY, LOAD AND MERGE which are available on the audio cassette interface, the manual refuses to admit to anything other than that there are some other keywords—OPEN#, CLOSE#, MOVE, ERASE, CAT, and FORMAT — which "will not work without Microdrive etc".

Data and program storage, for the time being, goes on the audio cassette. But this is a far nicer system than we used to have on the ZX81, where you could save a program or load it, and that was that. People who wanted to save data would have to disguise it as part of a program — in a long REM statement, for instance. Now, you can not only load and save data on tape as well as programs (and read them back in) but can check that they are correctly saved with the VERIFY command. You can also use the LINE command when saving a program, and when the program is LOADed again, it will start running all by itself from the line number. Most important, however, the machine actually shows you the name of the program or block which it has found on the tape. No human being will ever be able to distinguish one program from another by listening to the tape, and in the past, people were reduced to making vocal announcements before saving their programs. The opportunities for error were enormous.

It is even possible to dump a display to tape, and subsequently load it back onto the screen, with the command SAVE (or LOAD) "picture" CODE 16384,6912. The two numbers are the start address, and the length. They are automatically generated by the statement LOAD (or SAVE) "picture" SCREEN$. Picture is the name of the block, of course.

MERGE is worth special mention — it lets you LOAD a program on top of a previous one, just as though the new lines were being typed in from the keyboard (without a NEW command). So the line numbers stay the same unless the MERGE program has a line of the same. Then, the new line is substituted.

It is also possible to save the load new graphics characters (see below).

After all that enthusiasm, and adding that Sinclair has devised a system to make all this loading and saving much more reliable than on the ZX81, there are some reservations.

First, it may be more reliable than before, but it is far from reliable. My experience of using the system showed that around a quarter of the time, the LOAD command responded with "Tape loading error" rather than "OK". Providing the program was properly verified, that isn't the end of the world, but it is irritating (and I don't get that problem on the BBC machine).

Secondly, you have to much about with the plugs and wires. On most tape recorders, plugging computer output to tape input and tape output to computer input, at the same time, generates feedback when saving programs.

Third, you have to press buttons. I've been spoiled for this by several cheap systems which will turn the tape recorder motor off and on, and while I know it costs money, I feel it's worth the cash to have it. Obviously when the Microdrive is available, this will fade into insignificance.

2 The Basic

In alphabetic order, here are the new keywords, first the functions, then the statements.

ATTR — It finds out what character attributes are in force at that point of the screen. That means: is the character flashing, inverse video, coloured, etc.

BIN — Defines the next number as a binary number, so that 100 is 4, etc. You would normally use it for defining your own graphics character, with the "1's going where you wanted INK dots. The manual includes a nice version of this for turning the graphics version of P, N, R, K, Q, and P into chess pieces.

IN — The result of reading the input port (of interest to machine code games writers, mainly).

INKEY$ — Changed from the ZX81 version to allow the new upper and lower case input as well.

SCREEN$ — See above on tape handling.

USR — As well as its normal meaning of invoking a machine code routine, USR followed by a string is used to program your own characters (in graphics mode) like chess pieces, and so on.

VAL$ — Presumably somebody thought this was necessary, but I can't see why.

BEEP — There ought to be a law against describing the component in the Spectrum which responds to BEEP as a "loud"speaker. I shall refer to is as the "mouse" which grotesquely exaggerates its power. In a totally quiet room, you can detect a faint tone, which sounds for a certain time (you set it) on a certain note (starting with Middle C as 0, BEEP 1, 0 would play a one-second middle C). You can go up or down by whole or fractional semitones. to hear the thing, you have to play it through your amplifier, and if your amplifier is plugged in, you can't save programs. Silly.

(Note: the mouse automatically clicks its claws against the computer case each time you press a key. It would be a great idea, if you could actually hear it.)

BORDER — A number from 1 to 7 which sets the colour of the border round the edge of the screen.

BRIGHT — Some people say they can see the difference between the dark and bright versions of the eight available colours. I must have the wrong television set.

CAT — Disk command.

CIRCLE — Specify the centre point and the radius of a circle, and watch it draw itself there.

CLEAR — When used with a number, moves RAMTOP to that address, giving room for macine code routines or whatever, above.

CLOSE# — Disk command.

CONTINUE — Same as old CONT, but politer.

DATA — A new (conventional) way of storing data in a program rather than the old REM statement fiddle which users got accustomed to on the ZX81.

DEF FN — Probably the most useful single addition. It allows the user to define a new Basic instruction and say how it works, and what variables it needs when it is used. The BBC micro has this. The BBC micro also has a PROCedure function, just as useful, which shares some of the work of the Sinclair FN. It can make life a great deal easier for somebody else who is trying to sort out the mess you made in a program, if they can look up functions like this, rather than having to trace subroutines, and if only the function could be given a name, rather than a single letter identifier, it could be very helpful indeed.

DELETE — Disk command.

DRAW — One of the new graphics commands. It draws a line or an arc. Unlike BBC micro graphics, however, you have to take great care that you don't draw over points which aren't on the screen, or the program will stop with an error message. And because this machine has no ON ERROR GOTO function, your error trapping routine has to be absolutely foolproof. Thoughtless.

ERASE — Disk command.

FLASH — Exactly what it sounds like — one character at a time.

FORMAT — Disk command.

INK — One of the most powerful new colour commands, and a delightfully clear, easy way of inventing a new Basic word. The number that follows INK (or PAPER) is interpreted as follows:

0 Black
1 blue
2 red
3 magenta
4 green
5 cyan (light blue)
6 yellow
7 white

There is also the option of 8 (which says that the character is the same as its background (!) and 9, which declares that there shall be a maximum contrast.

The choice of numbers for colours may seem random, but in fact the ascending order is also the order of grey scale in which they appear on black-and-white (or green) screens.

INPUT — Of course the ZX81 had INPUT! But this time, the difference is startling, because we have INPUT AT and INPUT "Hello, can I have your number"; number, and several complicated and powerful permutations of that. There is one small carp here.

(Continued on Page 57)

Understanding data structures

PART 3

by N. K. Freestone

In many situations a more complicated data structure is required than either static arrays and matrices (Parts 1 and 2 of this series) or the ordered sequences of stacks and queues (Parts 3 and 4) can give. These situations include those where the size of the data collection is varying as processing proceeds, where there is a need to insert, delete or amend the present structure or where the relationships between items is complex.

A structure that meets these requirements is the LIST, in fact not a single structure but a family or related structures.

The basic unit of the list is the "cell" or "node". This consists of several consecutive bytes or several elements in arrays that between them provide two types of information.

1. **DATA i.e. the value(s) held by the cell.**
2. **LINKAGE information.**

The linkage information consists of either references to adjacent cells in the structure or coded information to special cases like the top or bottom of the list.

Lists may be categorised by the system of linkage used in each cell.

SINGLY LINKED LISTS

Each cell in a singly linked list contains one linkage word or byte which is the address or element number of the next cell in the list. The end of the list may be denoted by a coded value (e.g. -1) instead of an address.

Such a structure can represent an ordered set of items e.g. an alphabetical list of spare parts. Let us look at this.

Consider two arrays:

```
10 DIM P$(50)
20 DIM L(50)
```

The array P$ will hold the values in the list, in this case the values of up to 50 spare parts. The array L is a numeric array and will hold the linkage information for the list cells. The two arrays are related by their subscripts, i.e. L(1) is the LINKAGE value for cell 1 while P$(1) is the value of Cell 1, etc.

The following diagram shows a small part of both the arrays.

	L		P$
23	26	23	"DIODE"
24	29	24	"SOCKET"
25	30	25	"TRANSISTOR"
26	28	26	"PLUG"
27	23	27	"CAPACITOR"
28	24	28	"RESISTOR"
29	25	29	"SWITCH"

The numbers next to the boxes represents the subscript of that element, while the value inside the box represents the value of the cell or the value of the link.

Cell 27 contains the Capacitor (P$(27) = "CAPACITOR") while the linkage value points to cell 23 (L(27) = 23), this being the next cell in order.

Cell 23 points to cell 26
Cell 26 points to cell 28
Cell 28 points to cell 24
Cell 24 points to cell 29
Cell 29 points to cell 25
Cell 25 points to cell 30
(not on the diagram)

Each cell has its corresponding description so the order of the items represented here is:

Capacitor
Diode
Plug
Resistor
Socket
Switch
Transistor
etc.

It can be seen that the cells occur in a particular order which is determined by the link values but that this order is not the order in which the elements occur in the arrays. Since it follows that the first cell is probably not in the first element of the array it is usual to have a separate variable (say T, the Top of the list) to point to the first cell. In our example T would equal 27.

Such a LIST structure enables us to gain access to the Nth cell simply by following the pointers. Once the required cell is found we can insert or delete cells from this point. Various operations can be carried out on the whole list, such as splitting it into two lists, counting the number of cells or copying all or some of it.

Manipulation of these structures may be carried out either by:

1. **A specifically designed list processing language.**
2. **Direct addressing to the cells; e.g. in Assembler, or using Peek and Poke in BASIC, or with languages like CORAL which allow direct addressing to memory.**
3. **By references to array elements in languages like BASIC. This is the method to be used in the following examples.**

Let us look at some examples of the operations mentioned earlier, as applied to our list of spare parts.

1. FOLLOWING THE POINTERS

This example routine will print all the spare parts in the list by following the pointers, starting at the top of the list. A working pointer (W) is used to point to the "current item" and the end of the list is marked by a pointer value of -1.

```
1000 LET W = T          get pointer to first
                          item
1010 IF W = -1          check for end of list
  THEN GOTO
  1050
1020 PRINT              if not end then print
  P$(W)                   the item
1030 LET=L(W)           set working pointer
                          to point to next
                          item in list
1040GOTO 1010           go round again
1050 PRINT              end of list has been
  "END OF                 found
  LIST"
1060 RETURN             continue
```

After each part is printed (Line 1030) the working pointer is set to the value of the link part of the cell so that it references the next cell.

Note that this routine can very easily be changed to perform a number of other functions e.g. to search a list for a particular value substitute an IF statement for the PRINT statement and test for the desired value and jump to an appropriate place when the item is found. In this case processing will continue from Line 1050 in the event of the list not containing the sought for value.

2. ADDING ITEMS TO THE LIST

In order that items may be added to a list it is obviously necessary to have some otherwise unused cells available into which new values can be placed.

Assuming that the whereabouts of these cells is known it is a straight forward matter to place the new value in the DATA area of the cell.

Some thought must be given however to maintaining the correct pattern of LINKS to the new cell.

Three cases arise here:

a) Adding the item to the **end** of the list. is the simplest case of the three. Since, in our example, the last item has a LINK value of −1 then the new cells link should be set to this value because it will be the last item in the list. Secondly the cell currently on the end of the list must have its link value changed from −1 to point to the new item. This establishes the proper links to the new cell.

b) Adding an item to the top of the list also requires two operations. The value of the variable T (which points to the top cell) must be entered in the LINK part of the new cell so that it points to the old top cell and the value of T must be changed to point to the new cell.

c) Adding an item into the middle of a singly linked list is slightly more complicated. A search is required to locate the two cells between which the new one will be placed. This is simplified if it is possible to locate the cell which will immediately precede the new one in the sequence. In this case the LINK value automatically identifies the cell that will follow the new one.

Usually however it is necessary to search down the list until a cell is found that has a value greater than the new one. The new cell is then inserted before the one found in the list. Since each cell has a pointer to the next cell, but not to the previous cell in sequence, it will be necessary to keep a "mental note" during the search of the number of the previous cell at each step through the list.

This can be done by adding the lines

```
1005 LET P = -1
1025 LET P = W
```

to the routine given earlier. Assuming that the new cell value to be added is in N$, and S is the number of a spare cell to put the new value in, the routine to add new cells becomes

```
1000 LET W = T
1005 LET P = -1
1010 IF W = -1 THEN GOTO 1050
1020 IF P$(W)½ = N$ THEN GOTO 1050
1025 LET P = W
1030 LET W = L(W)
1040 GOTO 1010
1050 LET P$(S) = N$
1060 LET L(S) = W
1070 IF P = -1 THEN GOTO 1100
1080 LET L(P) = S
1090 RETURN
1100 LET T = S
1110 RETURN
```

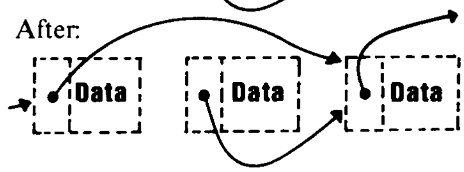
NOTES:

1005	Sets P so we can detect when to add the new cell to the top of the list, in conjunction with line 1070.
1010	Detects the end of the list.
1020	Check the values during the search.
1025-1040	Save the pointer value when the IF statement fails and go round again.
1050-1060	Set up the new cell when the IF Test is successful.
1070	Tests for the special case of adding the item to the top of the list.
1080	Adjusts the link of the cell before the new one to point to the new cell while . . .
1100	Adjusts the Top pointer (T) to point to the new cell when it is the first one in the list.

Some thought must also be given to removing an item from the list. Again, the same three possibilities exist depending on the items position in the list. In each case the item is removed by making the link of the cell before, equal to the link value of the cell to be removed. Since the link of the cell to be removed points to the next cell, placing this value in the previous cell will create a chain of pointers which bypasses the deleted cell.

Before:

After:



To remove the first cell the pointer (T) to the top cell must be changed to point to the second cell thus bypassing the deleted cell and to remove the last cell the end-of-list market value (−1 in the example) must be placed in the second to last cell thus terminating the list there.

Amendment of a list is achieved either by altering the value of a cell without affecting the links or by deleting the cell from one position in the list and adding it again in another.

Having discussed this processing in some detail let us look at some other list structures the processing of which is very similar to that already described.

CIRCULAR LISTS

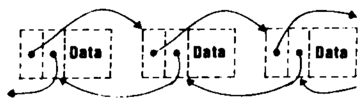
Sometimes it is convenient to make a list like the one described above circular. This can be achieved by using the LINK of the last cell to point back to the first cell. This can be useful where there is some relationship between the ends of the list as well as between adjacent items.

SPARE CELL LISTS

It was mentioned earlier while discussing the addition of a new cell to a list that it is necessary to know the location of a spare cell into which the data can be placed. It is common practice to compile all unused cells into a list with their own pointer say S (for spares). This allows easy access to spare cells for addition to other lists and cells deleted from other lists can be linked back into the Spare Cells List for later re-use.

DOUBLY LINKED LISTS

A single cell can be removed from a list if its "address" is known, but it does require a complete circuit around a circularly linked list in order to locate the neighbouring cells that must be linked together. It is necessary to read the whole list in order to locate the previous cell to the one being deleted. As this is a frequent operation on lists, which is particularly time consuming if the list is a long one, many lists maintain both forward and backward pointers from each cell. A doubly linked list:



Thus by following the first pointer in each cell the list may be read forwards in order, and by following the second pointer in each cell the list may be read backwards.

The extra linkage values do not necessarily involve much additional storage requirements as both pointers can sometimes share one word of store.

Now if we know the location of a cell it can be removed from its list without even knowing which list is involved because the two pointers identify the two cells which must be linked. Thus in a program that uses several doubly linked lists a single routine can perform all cell deletions when it receives a single parameter giving the address of the cell concerned.

All routines manipulating these lists must of course ensure that both sets of pointers are correctly adjusted in order to maintain correct cell linkage.

THREADED LISTS

When part of the data in a list is information that takes a limited range of values e.g. whether a person is male or female, it may be worthwhile setting up additional pointers in the list to the next cell of the same type. When a search of the list is performed for criterion which includes the fact that the person is (say) female, we can follow these additional pointers and so search only a subset of the whole list. A series of header pointers would give the first cell containing an item of each type.

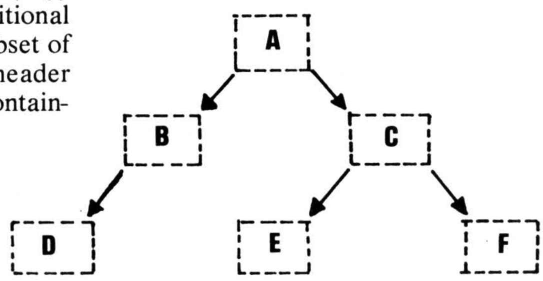
Multi-thread lists can also save space by avoiding data duplication. In a list of (say) stock items it may be required to access the list in several different orders e.g. alphabetically on the description, numerically on the part number or by delivery date order. If a three sets of pointers are used to link the list in each order then duplicate copies of the list, each in a different order, or the need to repeatedly sort a single list is avoided.

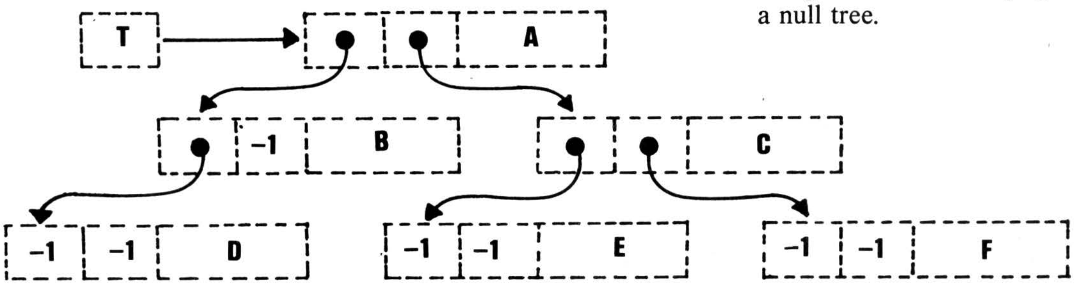
While we have lost some of the ease of inserting and deleting items from such a list, it can be analysed comparatively simply.

REPRESENTATION OF TREES BY LISTS

The various elements in a Tree Structure may be positioned in a List, but the links which should be maintained depend upon the application for which the tree is to be used. Any Tree Structure can be represented as a Binary Tree and this will be the only method described here.

The obvious method is to maintain two pointers in each cell pointing to the left and right sub-trees respectively, and using a terminal value (e.g. –1) to denote a null tree.





EG. A tree (T) and the corresponding data and links.

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Issue 7

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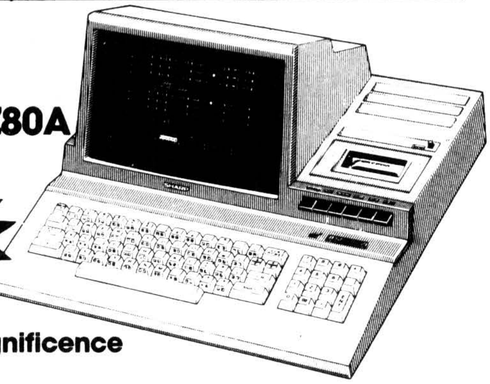

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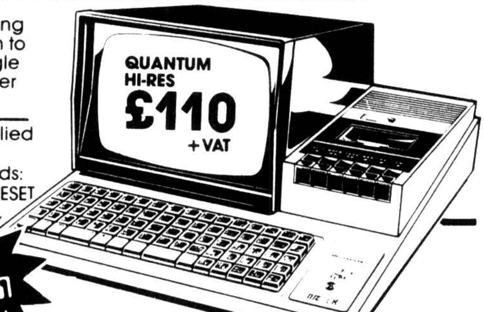

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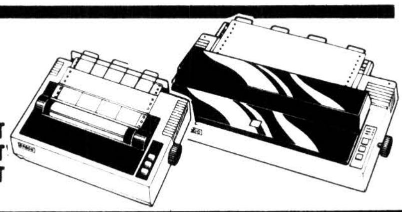

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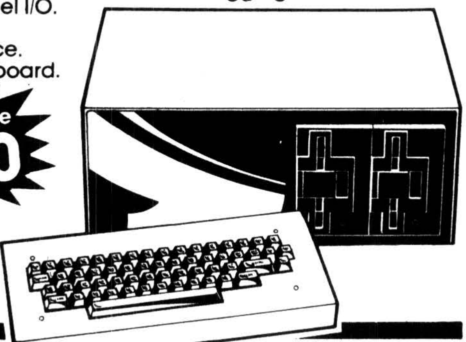

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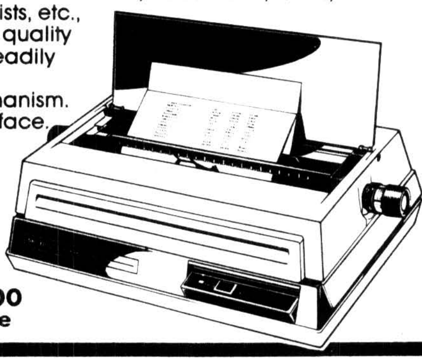

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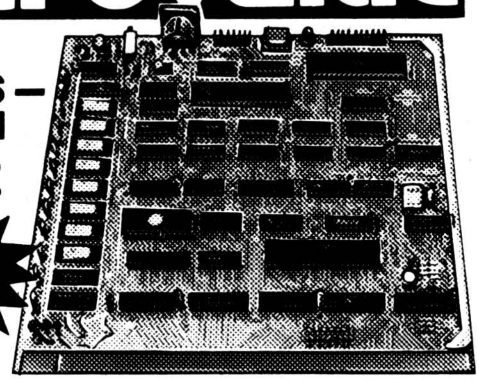

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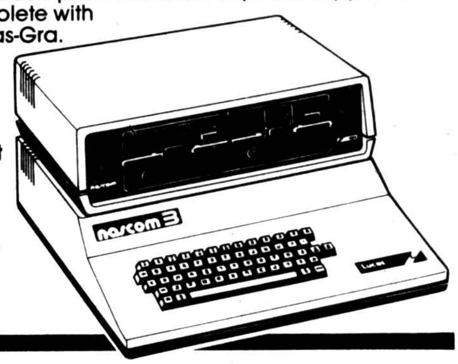

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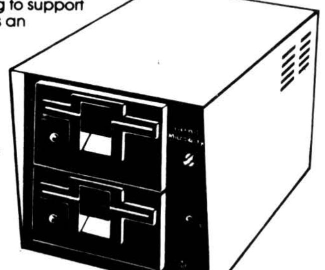

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NOTTINGHAM Skytronics, 2 North Road, The Park. Tel: (0602) 45053/45215

EGHAM, SURREY Electrovalue Ltd., 28 St Judes, Englefield Green. Tel: (0784) 33603. Tx: 264475

LEEDS Leeds Computer Centre, 62 The Balcony, Merrion Centre. Tel: (0532) 458877

MANCHESTER E.V. Computing, 700 Burnage Lane, Burnage. Tel: (061) 431 4866

WETHERBY, W.YORKS Bits & PC's, 4 Westgate. Tel: (0937) 63774

PART 3
by Owen Bishop

ZX81 MOTHERBOARD

The motherboard allows several different circuits to be connected to the ZX-81 at the same time, greatly increasing the scope of the system. For example, if you have the controller card which was described last month and then make the thermometer board (next month), the computer can read temperatures indoors and outdoors and operate the domestic heating system accordingly. With the addition of the real-time clock card, the computer knows the time of day, and what day of the week it is, and can run the heating system on different schedules at different times. In the field of model control, an assortment of sensors can provide input by way of a sensor card, and the controller card is made to take appropriate action.

This motherboard takes up to 3 cards. By setting it out on a wider board the design can be extended to include more cards than this. It allows the printer and 16K RAM pack to be plugged in at the same time as the cards, so you can assemble a really complicated system.

Another feature of the motherboard is its 5V regulated power supply. As can be seen from the pattern in Fig. 2, the 5V line from the ZX-81 continues across the board to the edge connector, but does not go to the sockets. The on-board 5V supply to the sockets comes from the regulator (ICI, Fig. 3). This avoids the risk of overloading the 5V regulator of the computer board. The on-board regulator derives its power from the unregulated 9V supply of the computer. There is the risk that if the printer, the extra RAM and three cards which require high current are all operating at once, the 9V transformer may be overloaded. This risk can be assessed only by adding together the requirements of each item connected to the system, not forgetting the requirements of the computer itself. The ZX Power Supply is rated at 700mA, which allows 600mA for the computer and 100mA for attached cards or 16K RAM, so there is little to spare. The controller card is probably one which requires more than average current. In the quiescent state it draws 25mA, but requires additional current for every switch that is turned on. Each relay takes 18mA when energised from the 9V supply. If more than 2 relays are to be used, it is essential to provide more power. Adding the printer increases basic power requirements to 1.2A, not allowing anything for the cards. A total of about 2A should be sufficient for most systems which include the printer, the 16K RAM and three cards on the mother-board. This can be supplied from a single 2A power pack, or a 700mA Sinclair power pack can be used for the computer, with the mother-board being powered from a separate 1.2A (minimum) pack. The wiring is shown in Fig. 4.

SYSTEM BUS

As explained last month, the cards all have the same arrangement of lines at their edge-connectors so that they arte fully compatible with each other and with the computer. This arrangement follows closely that of the ZX-81 edge-connector, so as to make interwiring as straightforward as possible. The ZX-PLUS system bus is listed in Table 1.

CONSTRUCTION

The mother board has been designed to fit on to a double-sided copper-clad board of standard size. Since the dimensions of this board are exactly 8″ by 3.75″ and the edge connectors have 0.1″ pitch, all dimensions are in inches instead of their metric equivalents. The ZX-81 board is double-sided so, to make the edge connector of the mother board compatible with the printer and 16K RAM, this board must be double-sided too. However, it is much simpler to construct the cards on single-sided strip-board, so the mother board provides a single-sided array at its sockets. There is just room for 3 sockets, and these can be added one at a time as the system grows.

With many close parallel lines to be etched, it is highly recommended that rub-down etch-resistant tracks be used. These are usually printed 0.1″ apart, and they can be cut into blocks of parallel tracks of suitable length. Several tracks are rubbed down in one operation. Circular pads are recommended for the points where the terminal pins are to be soldered, and two 23-way edge-connector patterns are also needed.

The design occupies the full width of the standard board. The edge-connector lug is formed simply by cutting away the two rectangles of board to its left and right. Make a reference mark in pencil on

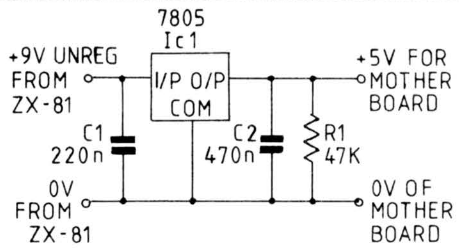


Figure 3 Circuit of the regulated 5v supply for the mother board

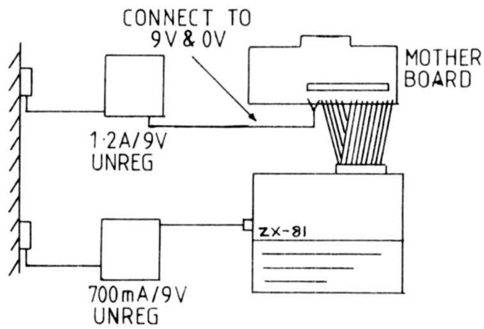


Figure 4 Using two power packs. The 9v line between the ZX81 and the mother board is omitted, but the OV Line and the 5v lines are retained.

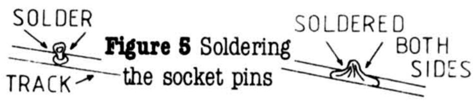


Figure 5 Soldering the socket pins

the edge of the edge-connector lug to coincide with the intended position of the RFSH and ROM C/S' tracks. The mark should be exactly 2.7" from the right-hand end of the board. This mark is essential if the two sides of the board are to be perfectly registered with one another. On both sides of the board scratch thin lines to mark the positions of the rows of holes to be drilled for the sockets. The first is 0.6" from the front edge, the next is 0.7" from this and the third is 0.7" from the second. A shorter fourth line is required 0.2" from the third line, to show where the connections between tracks on the opposite faces of the board are to be made.

Having marked these points which are especially critical for obtaining good registration, clean the board with Vim or whatever material is recommended for use with the particular etching method you are employing.

1. There is a gap at socket pin 37 for the key.
2. There is a gap in the edge-connector at the third position, for the keyway.
3. The 0V line is a double-width track, since this is likely to carry larger currents than other tracks.
4. The 5V supply to the sockets comes from the regulator, **not** from the 5V pin at the front of the board.
5. The track from the 5V pin at the front of the board by-passes the sockets.
6. The RFSH (dynamic memory refresh line) and the ROM C/S' (select line for the computer's ROM) also by-pass the sockets.

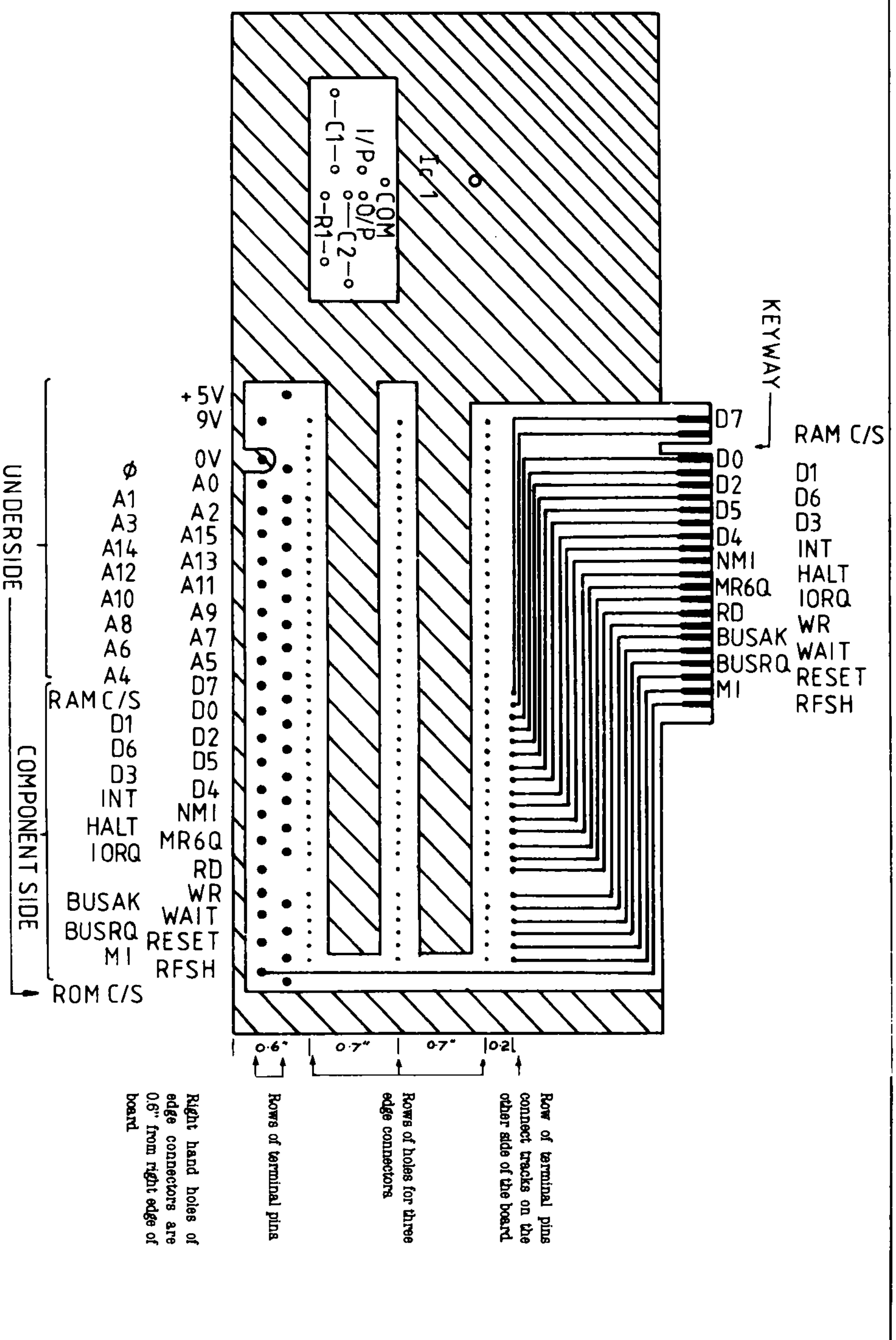
When the tracks and pads have been laid out, the vacant areas of the board are covered with Sellotape or similar material so as to leave these areas as copper. The board is then etched.

After etching, cut the key-way in the edge connector. Some patience is required in drilling the many holes and in soldering the sockets and terminal pins. Points to note are:

1. If you are not fitting all three sockets to begin with, do **not** drill the holes for them. Drilling the holes is very likely to cut the track completely, disconnecting the edge-connector. When the socket has been soldered in, the solder bridges the gaps in the tracks. When soldering the sockets, make sure that the near and far sides of all pins are properly soldered to the tracks (Fig. 5).
2. The 0V pin is soldered both above and below the board, to link the ground planes on both sides.

Continued overleaf ▶

Top of the Mother Board



70% of original

3. The RFSH pin must be soldered **above** the board, while all other pins are soldered below.
4. The lines to the upper side of the edge connector pass through the board by way of terminal pins, which are soldered both above and below the board.
5. Check all tracks carefully using a hand lens. If any are broken, repair them with soldered bridges.
6. Check that there are no short-circuits between tracks. Use an ohmmeter to confirm that every track is isolated from its immediate neighbours and from the 0V line.
7. When the regulator circuit is complete, check its action using a 9V rectified supply. 5V should appear on pin 1 of every socket and nowhere else. Similarly 9V should appear on pin 2, and at the correct pad of the edge-connector.

CONNECTION TO THE ZX-81

If you made up a cable for last months circuit, you will probably have already removed the single-sided socket to mount on the mother board. Trim the solder-covered ends of the wires neatly and solder them to the pins of the mother board.

If you have not already made a cable, first cut sections from both ends of the 43-way double-sided socket so that its key comes at position 3. The aperture in the rear of the ZX-81 case is only just wide enough to allow a 23-way connector to be inserted. File the cut ends of the socket so that it slips neatly into position onto the edge-connector of the ZX-81.

Remove the socket from the board. After checking which **is** the upper side, solder a length of 20-way ribbon cable to the pins on the upper side of the socket, from D7' to RESET (Fig. 6). Ribbon cable wires are usually multi-stranded. Twist the strands firmly together and coat with solder before soldering them to the pins. This makes it less likely that stray strands will cause short-circuits between adjacent pins. Solder an equal length of 20-way cable to pins on the lower side of the socket, from φ to ROM C/S'. This leaves two spare wires beyond ROM C/S', which are soldered to RFSH and M1 on the upper side at that end of the socket. Use flexible wire of rather heavier gauge (say, 10/0.1) for the 0V, 5V and 9V pins. The other ends of the ribbon cables and the power lines are then soldered to the terminal pins of the mother board.

TESTING

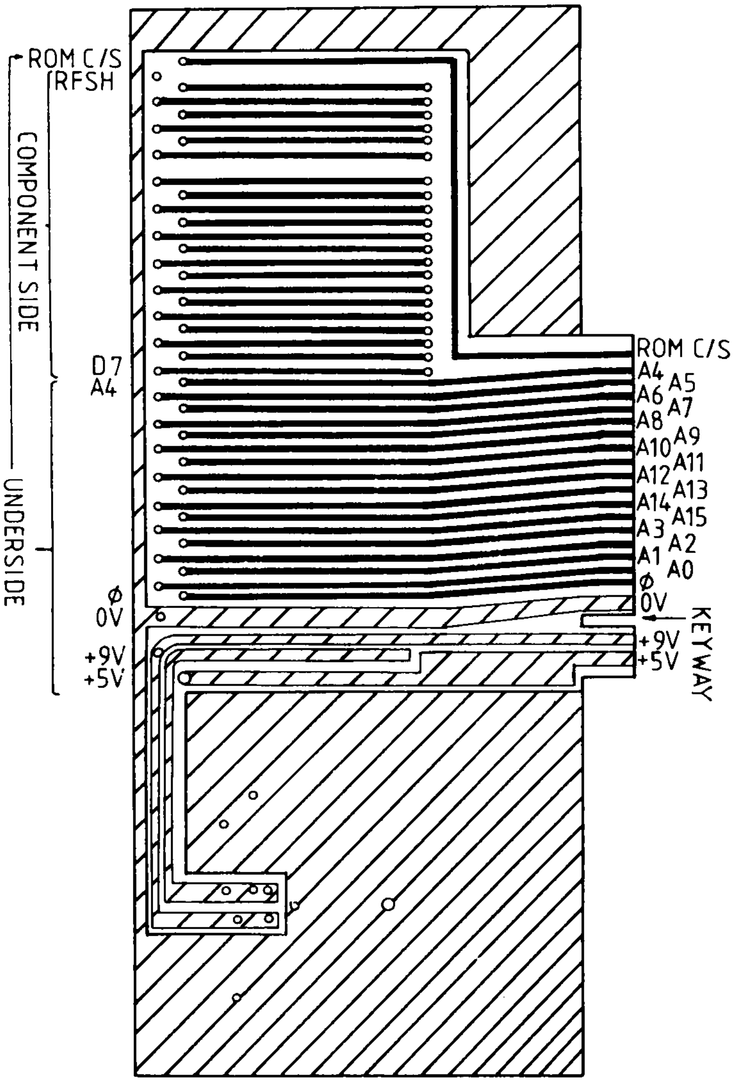
Before attaching the board to the computer thoroughly check all lines for:

1. Short curcuits between adjacent lines (including lines on the opposite edge of the 2-way socket), and the power lines.
2. Continuity between the double-sided socket, and the socket(s) and the edge connector of the mother board.

CASING

Whether to house the mother-board in a case or whether to settle for the 'bare-board' look is a matter of personal preference. At the beginning it is certainly more convenient to have free access to the cards for testing them and for wiring external devices to them, so the latter is a more suitable choice. Stick-on plastic feet should be fixed at

Bottom of Mother Board.



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the 4 corners of the board, with a fifth foot in the centre. This is to prevent the board from flexing unduly under the pressure caused by inserting a card in its socket.

The board is now ready for use. Hold the socket carefully as you push it on to the edge-connector of the computer. At this stage it is easy to bend some of the pins at the ends of the socket, so that they contact the pins next to them. Finally insert a card in a socket and switch on the computer. If the 'K' cursor does not appear on the screen, it is almost certain that a short-circuit exists despite all the testing. Switch off, unplug the cable socket from the computer and test again.

Table 1 The ZX PLUS system bus

Line	Name	Function
1	5V	Regulated power supply
2	9V	Unregulated power supply
3	0V	System ground
4	0V	System ground
5	ϕ	System clock (6.5MHz, from the computer)
6	A0	
7	A1	
8	A2	
9	A3	
10	A15	
11	A14	
12	A13	
13	A12	Address bus
14	A11	
15	A10	
16	A9	
17	A8	
18	A7	
19	A6	
20	A5	
21	A4	
22	D7'	Data bus, via resistor
23	$\overline{\text{RAM C/S'}}$	Chip select for the computer's RAM
24	D0'	
25	D1'	
26	D2'	
27	D6'	Data bus, via resistors
28	D5'	
29	D3'	
30	D4'	
31	$\overline{\text{INT}}$	Maskable interrupt
32	$\overline{\text{NMI}}$	Non-maskable interrupt
33	$\overline{\text{HALT}}$	Indicates that the Z80 has stopped action, awaiting an interrupt
34	$\overline{\text{MREQ}}$	Z80 is ready to read or write to memory
35	$\overline{\text{IORQ}}$	Z80 is ready to input or output data
36	$\overline{\text{RD}}$	Z80 is reading (receiving) data
37	—	CONNECTOR KEY HERE
38	$\overline{\text{WR}}$	Z80 is writing (sending) data
39	$\overline{\text{BUSAK}}$	Z80 is handing over control of data and control busses to an external device
40	$\overline{\text{WAIT}}$	Addressed memory or other device is not ready to receive or send data
41	$\overline{\text{BUSRQ}}$	Requests Z80 to give control of data and control busses to an external device
42	$\overline{\text{RESET}}$	Resets Z80 and other devices
43	$\overline{\text{M1}}$	Machine Cycle One; indicates that the Z80 is fetching an instruction from memory

PARTS REQUIRED

R1 47kΩ, carbon, 0.25W, 10%

Capacitors

C1 220nF, polyester

C2 470nF, polyester

Integrated circuits

IC1 7805, 5V regulator

Miscellaneous

Double-sided epoxy glass copper-clad board, 203mm x 95mm (8" x 3.75")

43-way single-sided edge connector socket, 0.1" pitch (1 to 3 off, as required)

43-way double-sided edge connector socket, 0.1" pitch (1 off)

Terminal pins, 1mm, single-sided (43 off)

Stick-on plastic feet (5 off)

20-way ribbon cable (about 0.5m)

Connecting wire, solder, materials for etching.

Part 2

by Ian Sinclair

USING MENTA

Microprocessor programs are written in "assembler language", using the mnemonic codes for instructions, and with data or addresses written as label names or in hexadecimal code. Any assembler program, such as the excellent ZEN, available for the TRS-80 and the SHARP MZ-80K, will then permit these mnemonics and labels or hex numbers to be typed, one instruction per line, and assembled. Assembly means that the mnemonics are converted into the correct operating codes which will be shown on the screen of the computer as hex codes, but stored in the memory of the computer as binary code.

Computers which do not have an assembler program available have to make do with POKE instructions in BASIC to place the bytes of machine-code into memory. Since POKE instructions in BASIC as normally in denary (scale of ten), this is very tedious, because the hex equivalent of each instruction must be looked up in a list, then converted to denary, and written alongside the memory address at which it has to be poked.

MENTA is a unique Z-80 assembler which contains both hardware and software. It uses a Z-80, with 8255 programmable input/output port, 1K of RAM (static), along with character and display generators. The port connections are taken to a 26-pin plug to which a matching socket can be connected if the MENTA unit is to be interfaced to other circuits. There are also external sockets for a TV receiver aerial lead, a power supply (8V unstabilised), and for connection to and from a cassette recorder.

The unique features of MENTA start with the keyboard. Instead of using a purely hex keyboard, MENTA keys are labelled with Z-80 mnemonics, featuring all but the least-used instructions. By making use of these keys, a program can be keyed into MENTA in assembly language, needing no conversions, and will be viewable on a TV screen in hex. Even the normally awkward business of calculating jump addresses can be done automatically by using the ingenious MENTA operating system.

The program is displayed on the screen of any TV receiver, plugging the TV output lead of MENTA into the aerial socket and tuning to around Channel 35. The display shows the contents of a selectable 256 bytes of memory, starting with the first available address for writing programs. The display is in hex, with the cursor flashing, and the first byte of each instruction highlighted, so that the instruction bytes can be separated from the data bytes. The RAM of MENTA extends from F800 to FBFF (hex), so that each program will start at F800H unless some other address is chosen, and the screen will initially show the range of addresses between F800H and F8FFH. Other "pages", meaning blocks of 256 bytes can be chosen to be shown on the screen, but for our purposes in this series, the first page, page Ø, will be used almost exclusively.

The program stored in the RAM of MENTA can be displayed, edited and altered as needed, and then run. A successful program can be recorded on cassette for future use, or if in a development stage, for future editing. The cassette saving and loading system is one of the best ever fitted to any unit of this type.

SWITCH-ON AND HEX DISPLAY

MENTA is connected to its power supply, using the jack connecter on the extreme right-hand side at the rear of the unit (keyboard facing you). The TV connection is made to the adjacentphono socket, and MENTA can then be switched on by plugging its transformer directly into a 3-pin socket, and then pressing the RESET key twice. The output to the TV on or around Channel 35 should then be carefully tuned, altering the brightness and contrast controls if necessary, until the page of hex characters sent out by MENTA appears on the screen. A portable TV, such as the Ferguson 3810, will give the best results, colour TV receivers, in general, give poor results. ▶

As usual, switching on gives a set of "garbage", meaningless bytes in the RAM. These can be cleared by pressing the CLEAR key of MENTA **twice,** with each keypress acknowledged by a short bleep from the built-in loudspeaker. The need to press certain critical keys twice is a safety feature of MENTA — anything that might call for second thoughts before a program is erased or run will require **two** key presses. The display should now show sixteen rows of hex bytes, sixteen bytes per row, all reset to zero, with a flashing cursor over the first byte at the top left-hand corner. This switchon procedure results in the display of the first of four pages, page 0, corresponding to the memory addresses in RAM F800H to F8FFH inclusive. The rest of the 1K of MENTA's RAM can be displayed by using the PAGE key followed by the number of the required page (∅ to 3) that is wanted. The page number is also displayed on the LED 7-segment display on the right of the keyboard. Though the CLEAR key (pressed twice) resets all of the memory, starting from the cursor position to the end of RAM, to zero, there is always a section of memory at the end of Page 3, from address FBC7H to FBFFH which is used by MENTA's operating system, and which will have bytes present, some changing as they are inspected. These addresses can be used to inspect the contents of registers and to make temporary alterations to the MENTA operating system if required.

THE CURSOR

The cursor is a square flashing block which is located on the screen at a position which corresponds to a memory address. The switch-on procedure will cause the cursor to be located at the HOME position in Page ∅, which is the top left hand corner of the page, corresponding to the first available memory address, F8∅∅H. When the unit is used, the cursor will move from this HOME position, and it can be returned there by pressing (once) the HOME key. The HOME key does NOT change the Page number, however, so that if the cursor is in the middle of Page 2, then to home it on Page ∅ requires the sequence of commands: PAGE ∅ followed by HOME.

The cursor is used as a marker, to indicate where bytes are stored in memory, or programs started, and so it is essential to be able to move the cursor freely. The keys marked UP, DOWN, RIGHT and LEFT will move the cursor in the directions indicated, and the movement will be repeated if these keys are held down, with wraparound. If RIGHT is pressed, for example, and held down, the cursor will travel **right** to the end of the current line then reappear at the **lefthand** side of the **next** line down, still moving to the right. Keeping the LEFT key pressed down will similarly move the cursor to the extreme lefthand side of a line, to reappear on the right hand side of the next line above. Using UP or DOWN in a similar way will cause the page number to change when the cursor reaches the top or the bottom of the screen.

If the STORE key is pressed, it will cause the RAM address corresponding to the cursor position to be stored. Pressing RECALL at some later stage will return the cursor to that stored address position, provided that another position has not been stored in the meantime. This simple position storage system is particularly useful for inserting jump addresses, as will be illustrated in a later Part of this series, dealing with jump instructions.

USING MENTA

At first sight, the MENTA keyboard looks rather complicated, but its operation is remarkably simple and well thought-out. When MENTA is not being used as an assembler, the markings on the keypads themselves are the relevant ones. The complete hexadecimal set, ∅ to F, plus all the control functions are therefore available, using one keystroke each apart from CLEAR and RUN which, as already noted, need two keystrokes each.

MENTA can be used as a simple hex programmable machine by pressing the keys corresponding to each byte of a program — since each hex digit takes up half a byte, two digit keys have to be pressed to cause the entry of a byte at the current cursor position, and the cursor then moves to the next position. The program must terminate with FF, which will ensure an orderly return to the operating system. Note that the addresses used will be in the MENTA range of F800H to FBFFH, so that if the program is one containing addresses outside that range (because it was intended for another machine) then these addresses will have to be altered before the program can be run.

A particularly useful facility permits the insertion or deletion of code at any position in memory. If the cursor is positioned over a byte, and INSERT pressed, the byte under the cursor and all the code bytes to its right (unless there is a gap of several zero bytes) are moved to the right, and the FF byte is inserted in the cursor position. This can be repeated to create as much inserted space as is needed for insertion of extra code, which can then be typed in to replace the FF bytes. Similarly, if the cursor is placed over an unwanted byte and the DELETE key is pressed, then that byte will be deleted, and the bytes following it in memory (right hand side) are moved up to fill the gap. This eliminates one of the objections to early assessment units that an insertion required re-entry of all the code from the insertion position onwards.

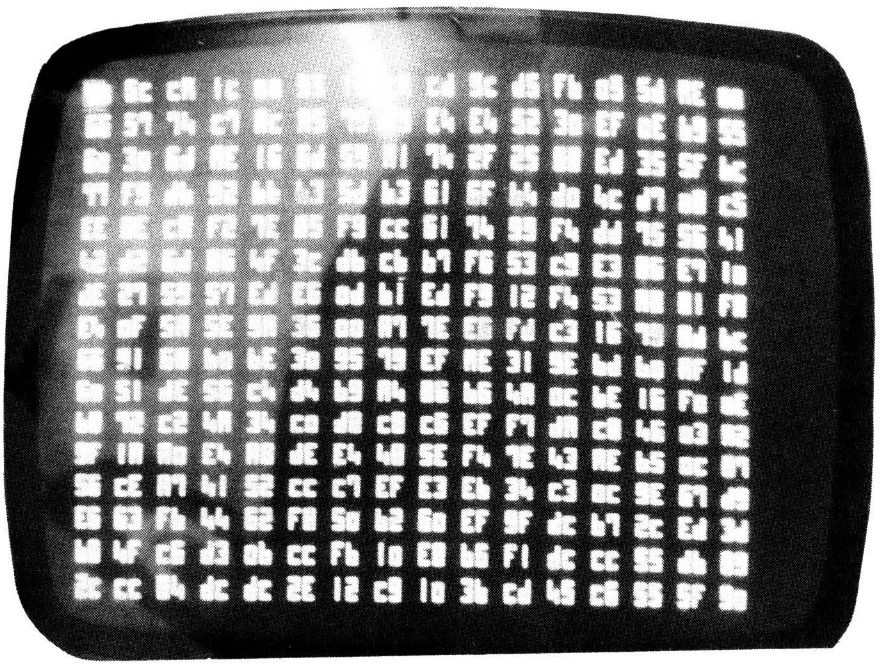
Having entered and checked the code — an easy task since most programs will fit on one page and can be inspected at a glance — the program can be run. Before running, however, it is prudent to save the program on cassette.

The recording system is unusual, because only one lead is needed, terminated by a 3.5 mm jack plug at each end. One plug is inserted into the remaining socket of MENTA, and for recording, the other plug is inserted into the MIC socket of a portable cassette recorder. The PLAY and RECORD keys of the recorder are pressed, and then the TRANSMIT key of MENTA. This causes the **whole** of the 1K of RAM to be saved on tape in a time of about 4 seconds, during which time the screen goes blank. When the display is restored, the recording is complete, and the recorder can be stopped.

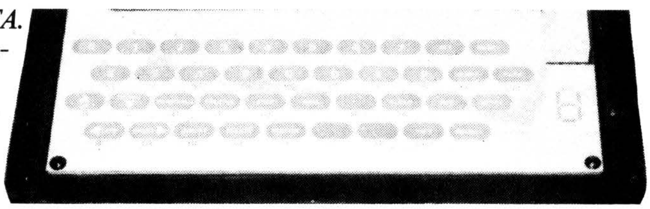
Replay is equally simple. The jack-plug at the recorder is moved to the EAR socket of the recorder, from the MIC socket, and the tape is rewound to its start position. The RECEIVE key on MENTA is pressed, and the TV screen will go blank. The PLAY key of the recorder is pressed, and if the volume control setting is correct (try half-way), then a set of dots will appear on the screen when the program is about to load, and will break up into random dot arrays when the program is loading. Return of the normal display indicates once again that the program has loaded successfully. If the display does not reappear, the volume level will have to be increased on replay. The system is quite remarkably tolerant of volume control settings, and using my TROPHY CR100 recorder (Curry's), and setting between ⅓ and full volume resulted in perfect replay of a program. I wish that makers of more pretentious machines would consult the designer of MENTA, Barry Savage, and learn how a good fast reliable cassette system can be designed!

RUNNING AND CHECKING

A program, once entered and recorded, can be run by replacing the cursor over the first byte of the program, and pressing the **RUN** key **twice.** If the program contains a closed loop, **accidentally** or **deliberately**, then the **INT key** can be used to recover control; **if this** is ineffective, the RESET will **have** to be used. If, however, the cursor **proceeds** in an orderly fashion to the last byte, the FF which is used as an end marker, the program has run successfully, and control has passed back to the operating system.



The screen display of MENTA. One complete "page" of data bytes is shown, in hex, on the screen, corresponding to 256 bytes in memory.



The keyboard of MENTA. Though this is of the touch-sensitive type, it is a well-designed one, with a beep from the loudspeaker indicating that a "key" has been correctly struck.

The effects of the program can now be analysed. Any memory address that was used can be inspected — its contents are displayed on the screen. It is particularly handy to arrange short programs on Page ∅, with their data held at the end of the page, so that the results can be seen at a glance. In addition the state of the ENTA registers can be inspected by pressing the REG key. This places the cursor over the location in Page 3 where the contents of the status or flag (F) register are stored. On the right of this byte are the contents, in order, of the A,C,B,E,D,L, and H registers. The arrangement follows the Z-80 convention of writing addresses into memory low byte first, then high byte.

The ability to inspect memory and register contents so easily is even more valuable when single stepping is used. When the cursor is placed at the start of a program, or over the first byte of any instruction (a highlighted byte), then pressing STEP will cause one single instruction to be carried out. This may cause the cursor to jump several bytes on, because an instruction byte may be followed by another instruction, or alternatively be several bytes of data which have to be read in order to complete the instruction. MENTA will carry out all the necessary steps, ending with the cursor over the next instruction byte. After a single step, the contents of registeres and memory can be checked to see if the instruction has had the desired effect, making debugging particularly easy. After inspecting registers, pressing RECALL will place the cursor over the next instruction byte.

ASSEMBLY LANGUAGE

What sets MENTA apart from all other microprocessor assessment units, however, is its ability to use Z-80 assembler mnemonics directly. Since machine-code programs are designed in assembly language, there is no need then to convert to hex codes, and in particular no need to calculate displacement values for relative jumps (see Part 7 for details). These features make the entry of code very much easier than has ever been possible on a unit at this price level before.

Assembly language entry starts with the cursor positioned over the place where the program is to start. the ASMBL key is then pressed, and this causes the top bar of the LED display to light. This is a reminder that the next keystroke will enter the code for one of the instructions shown in mnemonic form **above** the keys. When the key has been pressed, the LED display will change to light the bottom bar. This is now a reminder that the next byte must be selected from the register or flag references **underneath** the key positions. Any data (bytes or addresses) can also be entered in this way, looking at the symbols on the keys themselves, and the LED display will light the top bar again when all the data required for an instruction has been entered — this signals the need for a new instruction byte.

The screen does not show the code until the instruction is completely entered with all of its data, and any attempt to enter an impossible combination of instructions, registers or data will result in a protest from the loudspeaker. Once an instruction has been entered, it is shown in its entirety on the screen, with the first byte (the op-code) highlighted. The highlighting feature is extremely useful in tracing the steps of a program through for debugging purposes, but if necessary, the highlights can be removed by pressing the TIDY key, after which only the cursor is highlighted.

The assembler will cope with all but the least used of Z-80 assembly language instructions (mainly the block-shift instructions), which amounts to about 94% of all Z-80 codes being available in assembly language form. These unusual instructions are mainly single byte instruction, and can be entered in hex, so that the lack of assembly facilities is not a disaster.

The assembler use of MENTA is so useful that an example of the use of the keys to enter a piece of simple assembler language is needed. Suppose we wish to enter at the start of Page 0 the assembly language program shown in Fig. 1.

Starting with the cursor at its HOME position on Page ∅, press ASMBL. The top bar of the LED display then lights to indicate that a function printed above the keys must be entered, and the one we need is LD. When this has been pressed, the bottom LED bar lights to indicate that we need to choose a function printed under a key, in this case the rA key (under the CLEAR key). The LED bottom bar indicates that more is needed, so that the hex number keys ∅ and 6 can be pressed. The data entry terminates when the 6-key is pressed, and the complete code (3E ∅6) will then appear on the screen. At the same time, the appearance of the top bar of the LED display again indicates that the next instruction can be entered. This is LD again, and the bottom bar of the LED prompts once again for a register, rC this time, followed by rA. This completes this single-byte instruction, and the LD key can be pressed again, prompted by the top bar of the LED, followed by the HL (under DELETE) and the four keys that are needed to enter F8FF. Note that the commas which are used in assembly language (for the computer program to separate the parts of the instruction) are not needed for MENTA. The fourth instruction starts with LD again, but since the contents of register C are to be stored at the address held in the Hl registers, the next keys are the (HL) and the rC keys. The program entry is then terminated by touching the ASMBL key again to return to normal entry, and pressing the F key twice so as to enter FF, the code byte which returns control to the operating system.

In this state, the cursor is located over the next unused position, and the program is marked out by the highlights on the opcodes, the instruction code portions of the program. A more elaborate program would at this stage be checked for mistakes and then recorded, but for the purposes of this simple illustration, all that needs to be done is a quick check — the error detecting system of MENTA will have caught any attempt to enter impossible commands. The cursor can then be returned to the start of the program using LEFT (which will remove highlights) or HOME, depending on the starting position, and RUN pressed (twice). The time needed is negligible, so that only a faint flicker can be seen on the screen, and the cursor appears over the blank space following the FF command. Looking at the last memory byte on Page ∅, however, shows that this has changed to ∅6 as a result of transferring the contents of the C register to the address held in the HL pair, which is the address of the last byte in Page ∅, F8FFH.

Using REG to inspect the register contents will now reveal that the byte ∅6 is stored in both the A and C registers, as you would expect. Looking further along shows that the HL pair contains F8FF (remember the inverted order) again as expected).

A useful exercise at this stage is to press RESET, which will clear the registers and return the cursor to the HOME position on Page ∅. Pressing STEP will now cause the first command, coded as 3E ∅6, to be executed, which loads ∅6H into the accumulator. To check that this has been done, press REG, which will transfer the display to Page 3 with the cursor over the F-register byte. The next byte on the right of this position is the accumulator content, ∅6 as expected. You can now return to exactly the correct position in the program by pressing RECALL — this is automatic; there is no need to have used STORE first. This makes it unusually easy to flick between viewing registers and stepping through a program, and is one of the lesser-known advantages of using MENTA. Very few assembler programs, apart from the latest versions of ZEN for TRS-80 and VIDEO GENIE, allow for this quick and easy testing system, which makes MANTA an automatic choice for those of us who write Z-80 code as a matter of routine.

When longer programs, particularly programs which contain a counting loop, are run, the screen will go blank until the program ends, because the single Z-80 microprocessor cannot continue to serve the screen display while it is running the program. When a counting loop has to be tested, the most convenient method is to single step round the loop once or twice to check that the loop actions are correct, and then to alter the count to ∅1. If the count numbers are held in registers (usually BC), press REG, move the cursor along to the register position, and enter the new value from the hex keys. For example, if a count started with BC set to FFFF, the B register could be set to zero, and the C register to ∅1, than RECALL used to place the cursor back at the program step where it was interrupted. The end of the loop can then be tested without the need to go round 65534 more times!

Figure 1

Code	Assembler	Menta
		.... ASMBL
3E ∅6	LD A, ∅6	LD rA ∅ 6
4F	LD C, A	LD rC rA
21 FF F8	LD HL, F8FF	LD HL F 8 F F
71	LD (HL), C	LD (HL) rC
FF	HALT	.... ASMBL
		FF

A sample program, showing the hex codes, the assembly language version, and the MENTA keystrokes.

USING YOUR OWN ASSEMBLER

If you already own a Z-80 based computer along with an assembler program, you should be able to assemble and run the short examples which are contained in this series, but the ease with which you can do so depends very much on the assembler. Not all assemblers, for example, will permit code to be assembled directly into memory and tested there, and very few will allow single-stepping. The methods that you use will depend very much on what is available for your computer. It may be necessary, for example, to use an assembler program to create the code, and then record the code, load in a monitor program, then reload the assembler code so that it can be tested. This is a very clumsy procedure, and if you possess neither assembler nor monitor programs and have a keen interest in interfacing, then it may well be cheaper to buy MENTA than to buy the programs for your existing computer. If your computer uses a 6502 and you, very reasonably, want to learn Z-80 code, then buying MENTA is the only way out of the problem.

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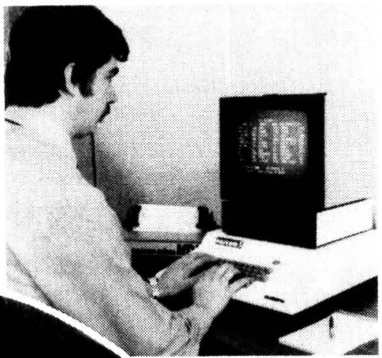

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When I was first asked to review a machine called the MicroEd, from NASCOM, I imagined that this must be one of the machines designed for the notorious BBC Microcomputer contract, and therefore intended to compete for Government subsidy and Educational Authority support with the "standard" machine which is the RML 380-Z. The present policy of the Dept. of Education & Science is to support two machines, the RML and the BBC MICROCOMPUTER.

Schools and Colleges which choose these machines have very strong inducements offered in the form of enormous discounts — 50% for first time buyers, which makes even the RML machine seem reasonably-priced — and extensive hardware and software support for establishments which re-equip or extend their computing facilities. Any assessment of the NASCOM contended for this lucrative market must therefore be in comparison with these two models.

We can assume at once that the NASCOM is not competing in the high-price world of the RML-380-Z. The 380-Z is a mainly-RAM machine which has its BASIC or other languages loaded from disc or tape, and its mainstay version is a very pleasant unit with 56K of RAM, and twin double-sided discs running CP/M. This makes up tinto a very powerful system (or will, when they sort out their network) capable of dealing with tasks which range from elementary BASIC tuition to full-scale data processing in COBOL. The NASCOM simply isn't in this class. This puts it into direct competition with the BBC machine, which is the pacemaker for the machines which are on offer at the moment and for those which will appear over the rest of this year. It's important to remember in this respect that Educational users do not pay VAT, so that the BBC machine costs them just over £200 even with **no** discounts or subsidies.

A photocopied sheed which was enclosed in the **very** provisional manual for the MicroEd seemed to delare the intention of the machine — to break away from the old image of NASCOM as a home-constructed spaghetti-special and be regarded seriously by educationalists. As a user of computers for educational purposes (including RML and BBC machines). I shall judge the NASCOM accordingly. In doing so I have to bear in mind that this is a machine with a long pedigree, a reputation for excellent reliability, lots of good software, and a wide range of add-ons available. It is also supported by what must be the most enthusiastic and dedicated User Group in the country and was at one time the flagship of British-made computers.

First impressions were anything but favourable. The NASCOM is a very large (21" x 17½" x 5¼") and heavy machine by modern standards, housed in a black case which looks like a chunk carved out of a vinyl car roof. The keyboard set in this expanse looks rather lst, and though the flat deck would be useful for sitting a video monitor, a cassette recorder and several ZX-81's, it does take up rather a lot of space. Presumably all the expansion can be done within the existing case, as is true of the RML machines,and the case was certainly sturdy enough for school use, something which can't be said for some of its rivals.

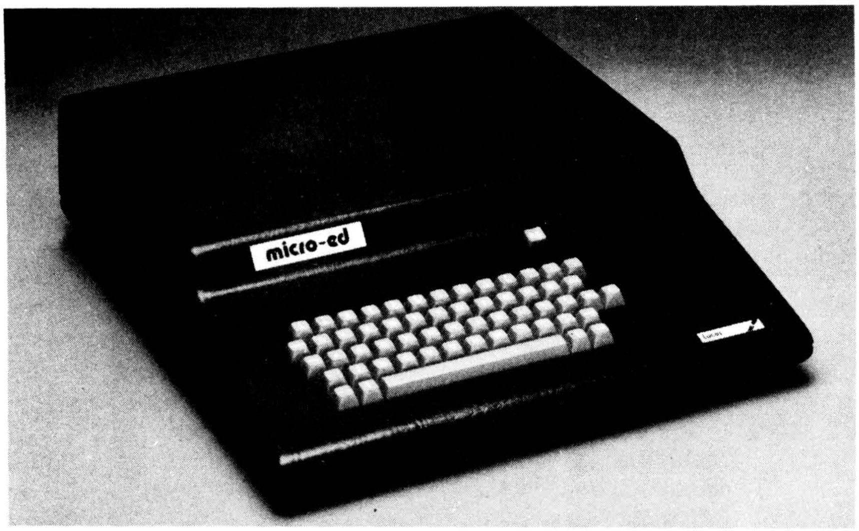
The provisional manual was basically that of the NASCOM-2, which appeared to indicate that the MICROED was a NASCOM-2 with a different sticker on the front. The manual was very much aligned to the old NASCOM image, partly dot-matrix printed, part daisywheel, partly typewritten, and partly typeset. It dealt in detail with construction from kit form, with the circuit, with the machine-code monitor, and it also mentioned BASIC. There was an index, but not a very helpful one — there was no entry for MEMORY MAP, for example, and this was typical of the frustration that the used would find in trying to dig information from the manual. The RML manual, incidentally, is worse; and only the BBC manual sets really high standards in manual production, reflecting the educational experience of its author, John Coll. NASCOM would certainly have to pay considerable attention to this point.

Taking the manual at face value indicated that the MICROED was a machine using 8K ROM and 8K RAM, and the screen message on the BASIC carried the 1978 MICROSOFT copyright notice. There are a large number of potential interfacing points on the back of the case, though on the review machine most of these were blanked off, leaving the cassette socket (a DIN-style socket with centre-pin for which I could not find a plug in time to test the cassette system), a serial-printer connector (now that most schools use the OKI microline with **parallel** interfaces), a video monitor output, using the BNC socket favoured by the BBC machine, and a UHF modulated output. I hooked in my video monitor and switched on.

First impressions were once again unfavourable. There was nothing to be seen on the monitor, and after pressing ENTER (not RETURN), I saw only SYS-3. This should have been NAS-SYS-3, indicating that the video monitor signal was designed for an under-scanning monitor. I can't change the scan width on my monitor, which functions well on the RML and the BBC machines, and it's unlikely that School or College users would want to try such adjustments. I changed over to the UHF modulated output. This gave better results, though the lines still filled the screen to an uncomfortable extent. Nascom should be aware, however, that the use of TV receivers in Schools is subject to considerable restrictions on safety grounds, and many authorities insist that all school TV receivers should use a double-wound mains transformer and have an earthed chassis. This makes them expensive and rare items, so that the use of cheap video monitors is quite widespread.

BY IAN SINCLAIR **NAS**

Moving on, the next question was — why should it start up in the monitor? There's no reason for the RML doing so, because only the monitor is in the ROM of the RML machine, but there seems no reason for a machine which has BASIC in ROM to start up in monitor — its just another chore for whoever switches the machines on. The manual suggested that switches or links inside the case could be altered to make the initial switch-on produce BASIC, and this would presumably be already done on production models — you can't expect school users to want to start getting acquainted with a machine by taking the lid off it. In any case, the application of the Health & Safety at Work Act has discouraged experiments, since any subsequent mishap can be pinned on whoever took the lid off, and teachers have enough to worry about as it is. The days when the school computer fell into the hands of a knowledgeable enthusiast are over — computers are increasingly being set up and used by teachers with no previous



COM "MICROED"

experience; that, after all, is what it's all about. The monitor startup looked like a hangover from the "constructor's paradise" days of the old NASCOM, and made me wonder if this was a serious attempt to get into the educational market or just a way of reducing stocks of the NASCOM-2 before a new model could be designed. The whole prospect stands or falls by one simple proposition — if you are Head of a School which by a year's efforts of Fetes and Jumble Sales has raised about £399, how are you going to spend it? Do you buy a half-price BBC machine plus a printer and other extras, or a full-price BBC machine (no VAT, remember) and some extras, or on ten ZX-81's (unsupported by the authority but on special offer) or on this machine (with nothing left over for even one cassette). Which gives you the greatest amount of computing now, and the greatest scope for expansion?

Much, of course, depends on the price level at which a computer can be sold. If the price is substantially below that of the BBC MICROCOMPUTER, then there may be a few buyers for an 8K ROM, 8K RAM machine which is capable of considerable expansion and is available now. In 1977, I would have thought the specification of the NASCOM excellent, but times have moved on since then, and the hardware which is on offer here is 1978 style, no U.L.A.'s, no switch-mode power supplies hence the massive size.

The BASIC . . . well, unless it is a very new design of BASIC there's not much to say. The 1978 MICROSOFT BASIC is well known. Any class learning NASIC will nowadays concentrate on the data processing and problem-solving aspects of the language, and the string handling of MICROSOFT BASIC is good, well known, easy to understand and generally available on other machines. Unfortunately, the cassette filing system of the MICROED is not exactly suited to data processing work. You will look in vain for commands like OPEN and CLOSE, PRINT and INPUT, used in data filing. All you have is a version of CLOAD and CSAVE (the program load and dump commands) which can be used to file variables, but NOT string arrays. This is very poor by 1982 standards, and though the manual mentions that the cassette system can operate at several baud rates, trying to find instructions for this is like the proverbial search for the needle in the haystack. This point once again raises serious doubts about the purpose of this machine. An enthusiast who already has a NASCOM can put up with all kinds of patching on inadequate systems, just to keep a solid and reliable machine running — I did the same for my TRS-80. We can't, however, expect to **buy** a machine which lacks todays fundamental requirements, particularly when the competition has much more advanced specifications at lower prices.

How does the machine shape up to everyday use. On the review machine, the RESET key had become detached, and there was no obvious way of securing it. The keyboard is pleasant to use from the touch point of view, and the keys have auto-repeat, but the ENTER key (it's not big enough to print RETURN on!) is not sufficiently distinguished by size, shape, colour or position to emphasise its importance to the beginner — it's also very easy to hit in place of the backspace. Though lower case could be obtained by using the SHIFT key along with letter keys, there was no SHIFT LOCK key. The manual advocated the use of the monitor K1 command to achieve shift lock, the alternative being a POKE from BASIC. The appearance of the characters on the screen was good, and the line layout of 48 characters per line and 16 lines per screen was clear, though the characters, oddly enough, looked larger than a 48-character line might suggest. This is a good compromise for UHF modulation, clear without being too large.

NASCOM has now been under new management, after the spectacular crash, for about a year, and if this is all they can come up with in the way of a computer for the fastest-growing market of all, then the year has not been well spent. This is still a computer for the home constructor who doesn't mind paying a lot of money for an unsophisticated machine just to get some experience of construction. There's nothing wrong with that, and a few schools with well-heeled electronics clubs might still be prepared to buy the NASCOM as a super test-bed for accessories. It simply cannot compete on any other grounds, however, either as a home computer, where it's up against the BBC machine, SPECTRUM, VIC, ATOM, ZX-81 and many more on the horizon, nor can it compete as an educational machine for which purpose it simply isn't adequate. The pioneering days are over. Educational users nowadays are not working with machine-code entered in hex (though the superb ZEN assembler is available — a point not even mentioned by NASCOM), they are not interested in taking the machine apart now and again to make minor changes. The main purpose of a computer in a School is to teach the use of a computer to solve problems, and quick and easy use without the mumbo-jumbo of "front-panels" and machine code monitors is essential, along with low prices and plenty of support from the local educational authority. With the geatest of respect for NASCOM, and the many enthusiasts who have had much enjoyment from their machines in the past, this is not a machine which can possibly hope to compete in today's marketplace.

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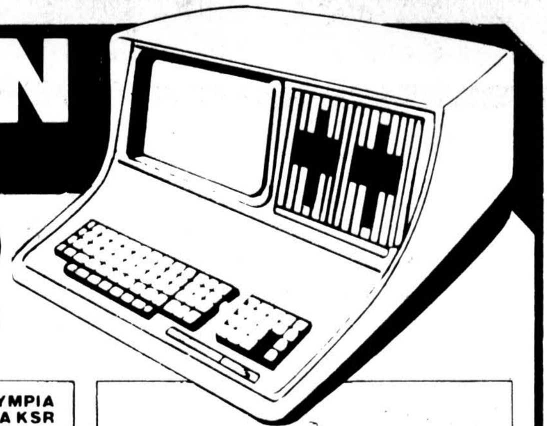

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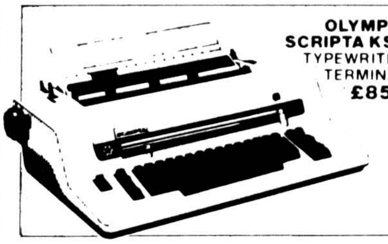

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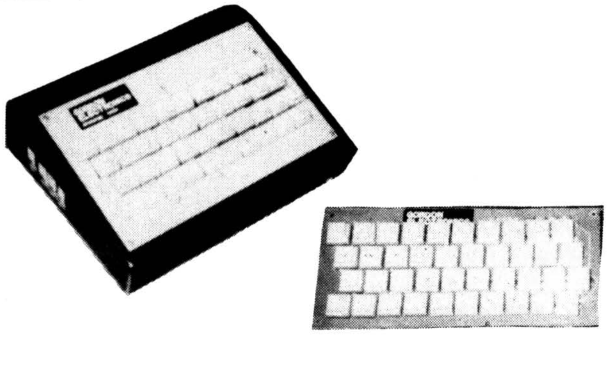

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SIMPLE DIGITAL INPUT-OUTPUT

by Paul Beverley, Norwich City College.

If you are interested in getting your B.B.C. microcomputer to control things, for example a model railway or a model racing car circuit then this and successive articles should be of help to you. However I'm going to start right from scratch so that even if you have never done any interfacing before, you should at least be able to get started once you've absorbed this article. What I will be assuming though is that you have some knowledge of binary and hexadecimal. If you haven't, then pop along to your local library and find a book which explains it. (Any suggestions, Ed?). You cannot get far with digital interfacing unless you understand the number system used by the computer, i.e. binary, and since binary is so cumbersome — all those 1's and 0's — we use hexadecimal (base 16) which is simply looking at four bits at a time, 2 to the power 4 being equal to 16. So to specify an 8 bit byte requires just two hexadecimal numbers.

What I shall do is to look at the whole idea of memory-mapped input/output which may well be a new idea even to those who have done some interfacing on Z80 based machines. Then I shall give a little bit of explanation about the 6522 versatile interface adapter which, to explain it fully would need a complete series all to itself, and then finally I shall give you a few circuits so that you can get started with a few simple experiments yourself, then as the series goes on I'll go into more detail so that you can go on to more advanced projects.

MEMORY-MAPPED INPUT/OUTPUT

In most microcomputers the information is stored in the form of 8 bit binary numbers, each of which is stored at a specific numbered location. This number is known as the address. At some of these addresses the information is stored in permanent form i.e. it cannot be changed. This is what is called read-only-memory (r.o.m.). Other information needs to continually up-dated and moved around and therefore has to be stored in read/write or random access memory (r.a.m.).

Within a r.a.m. chip are effectively vast arrays of transistors, the state of each transistor, on or off, representing one bit of one of the binary numbers stored in it. In memory-mapped input/output, what we do is to have a circuit which, as far as the computer is concerned, acts like ordinary r.a.m., but in fact, each of the transistors which represents one bit of memory has got a circuit attached to it so that its state can be looked at electrically from outside the computer, or so that its state can actually be changed by some external logic level. But unlike r.a.m., these memory locations can only either be written to or read from, but not both at the same time. Thus we talk about input and output ports. i.e. windows through which the computer can talk to the outside world and vice versa.

An output port then is a set of eight lines coming out from the computer, and each line will either be at logic 0 (0 volts) or logic 1 (+ 5 volts) depending on what number has been written to it by the computer. Each of these lines could then be used to switch on or off some electrical circuit such as a light or an electrical heater, or to operate some mechanical device such as a flow valve. Alternatively you could feed all eight lines into a device called a digit to analogue converter which would give you a single voltage out which was proportional to the binary number stored at the port.

As far as input ports are concerned what we have is eight lines which can be used to sense the states, logic 0 or 1, of each of eight different circuits. So when the computer reads the input port, the number it gets is made up of the individual on/off states of each of the lines, and it would then have to be programmed to interpret the number in terms of events in the circuits to which it was attached.

Just as the output port can be used to produce a single voltage, so the input port, if used with an analogue to digital converter, can be used to read the value of a voltage in an external circuit. The B.B.C. microcomputer actually has four of these circuits each of which uses 12 bits rather than 8 giving greater accuracy, and I dealt with how to use these from within BASIC in my article last month.

THE 6522 V.I.A.

The B.B.C. microcomputer has many different types of port — too many to deal with here, but the one I will look at is the 6522 versatile interface adaptor. This has sixteen 8 bit registers in it which can perform various functions, and their addresses are &FE60 to &FE6F. Of these, only two are actually ports which can be connected to the outside world, but the other registers can affect what happens at these ports in various ways. Also, both these ports are "bit-programmable", in other words each line can be individually programmed to be either an input or an output. The 6522 itself therefore can be used to provide 16 output lines or 16 input lines or any other combination in between. However on the B.B.C. machine, one of the ports has been provided with a buffer in order to make it suitable to drive a parallel printer and so those eight lines can only be used as outputs. So if you need more than eight inputs you will have to use one of the other ports. For example, there are two spare digital inputs on the connector for the paddles.

Address	Register
FE60	PB port - User port
FE61	PA port - Printer port
FE62	DDRB - Data direction register B
FE63	DDRA - Data direction register A

Figure 1 – Four of the registers of the 6522 v.i.a.

Interfacing the BBC Micro

DATA DIRECTION REGISTERS

In order to set each bit of each of the two ports as either input or output, there are two registers called data direction registers, DDRA and DDRB. Each bit of these two registers corresponds to a bit in port A or port B, and each bit acts like a toggle switch. If the bit is set (logic 1) then the corresponding bit in the port is set as an output, and if it is reset (logic

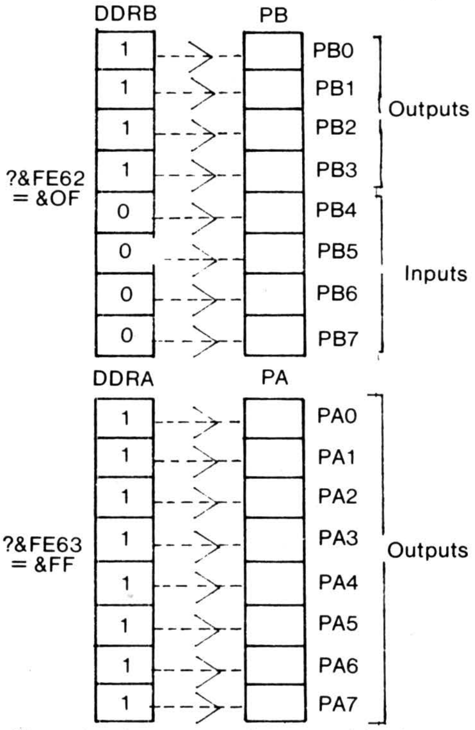

Figure 2 – An example of the use of the data direction registers

0) then the corresponding bit is an input. In the example given in figure 3, all of PA is being used for output, as of course in this machine it has to be, and this is done by putting 255 (&FF or binary 11111111) into DDRA. That is, all the bits of DDRA are set to 1, and this can be done from BASIC by saying

?&FE63=&FF

The "?" is the "byte indirection" familiar to Atom users and is equivalent to the more common POKE. i.e. POKE &FE63, &FF.

PB on the other hand is split into two halves — four input lines and four output. For this, DDRB has to be loaded with 15 (00001111 in binary) so that the four 0's correspond to the four upper bits being inputs and the four 1's, the four lower bits being outputs.

OUTPUT CIRCUITS

When you are using the computer to switch things on and off, you have to be aware of the amount of current which each output device in the computer is capable of providing. It is also worth noting that the amount of current is different depending on whether you are trying to "source" or "sink" current. i.e. it depends, as can be seen from figure 4, on whether the load through which the current is to be passed is connected to OV or +5V. Connecting it to OV is perhaps the more obvious way of doing it so that when the output is logic 0, no current flows, but when it is logic 1, current flows out of the port and down

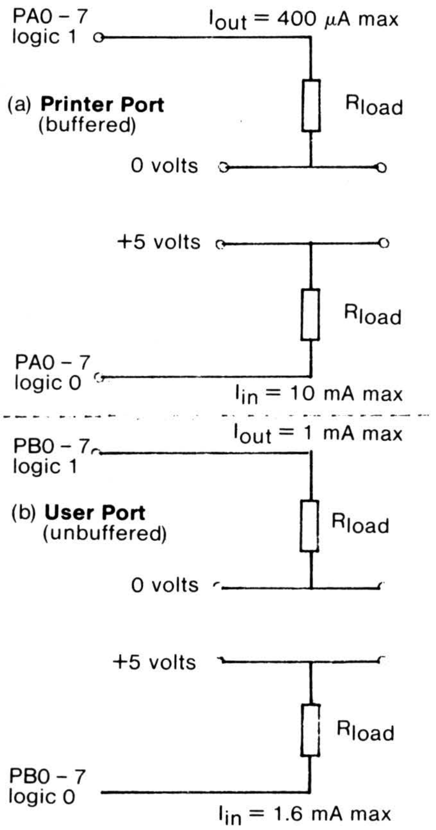

Figure 3 – Current capabilities of the printer and user ports

through the load resistor. That is, the port is acting as a source of current. If you connect to +5V however then when the output is logic 1, no current flows, but when it goes to logic 0 then current will flow down through the resistor and into the port — hence the term "sinking". Admittedly it is a little bit confusing that although the port is an OUTPUT, never-the-less current flows INTO the computer, but the computer IS still acting as an output because it is controlling whether or not the current should flow.

As you can see from figure 4, both the ports have a greater capability for sinking current than for sourcing it. Indeed it is quite possible to drive L.E.D.'s directly from the PA port as shown in figure 5. However this means that the L.E.D. will be ON when the output is logic 0 which might be a little confusing. But if you use a transistor as shown in figure 5 then it works more as you might expect, that the L.E.D. in ON for logic 1 and OFF for logic 0. The circuit shown can be used on either of the ports, provided that the transistor has a gain of at least 50 which is well within the capabilities of most general purpose NPN silicon transistors e.g. BC182, BC108, ZTX300 etc.

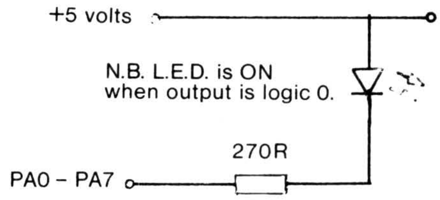

Figure 4 – Driving L.E.D.'s directly from the printer port

DRIVING RELAYS AND D.C. MOTORS

Relays and even small d.c. motors draw more than the 10 mA needed for an L.E.D. and the circuit design is therefore a bit more critical. The circuit shown in figure 6 allows you to switch 100 mA at up to about 20 volts, or even higher if you choose a suitable transistor. The circuit works by providing current to the base of the transistor through R1 and D2. This switches the transistor on and therefore the relay or motor is on. Then when the output line goes low, the current is drawn away from the transistor which switches off. Diode D3 is used to protect the transistor from the high reverse voltages which are generated when the current through the coil is switched off suddenly.

In order to switch even higher currents you will need to use two transistors in the so-called darlington pair configuration as shown in figure 7. This circuit should cope with more like 1 amp at up to about 60 volts, again depending on the transistors used.

But as a general rule it is worthwhile allowing for more current than you think you need, simply because if you cut it a bit fine, you may find your transistors getting rather hot. The point about using transistors as switches is this. When they are switched off then no current flows, so no power is dissipated. Then when it is fully switched on, the voltage drop across it is very small so the power dissipated is also small. But if you do not provide enough base current, then the transistor may not be fully switched on, in which case there may be an appreciable voltage drop across it which, with the current that is flowing, may represent an appreciable amount of power dissipation.

As far as motors are concerned, the only thing you have to beware of is that when they are stalled they tend to draw rather large currents, so you have to be sure that your circuit is capable of handling that maximum current.

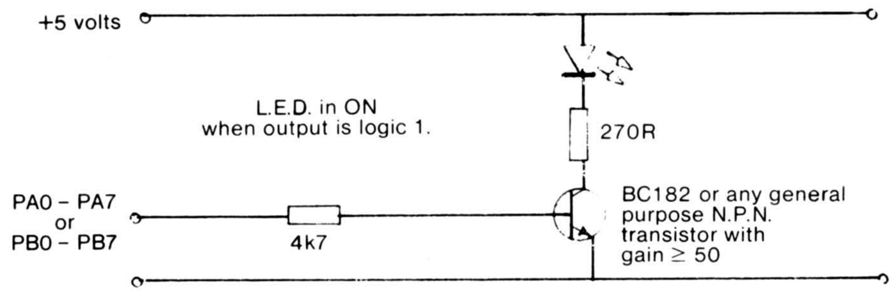

Figure 5 – Using a transistor to switch an L.E.D.

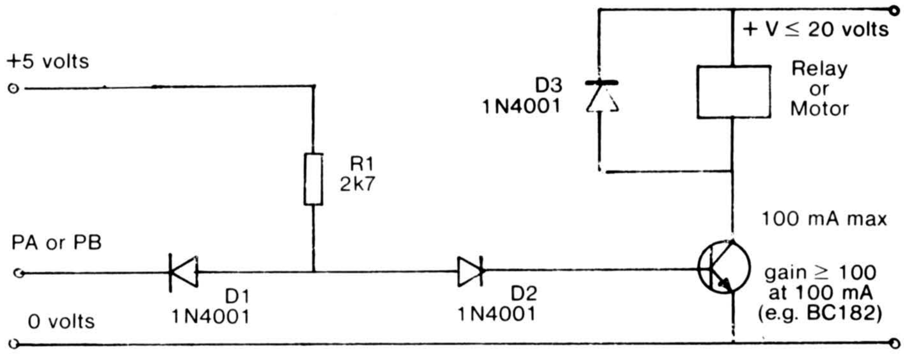

Figure 6 – Single transistor relay or motor driving circuit

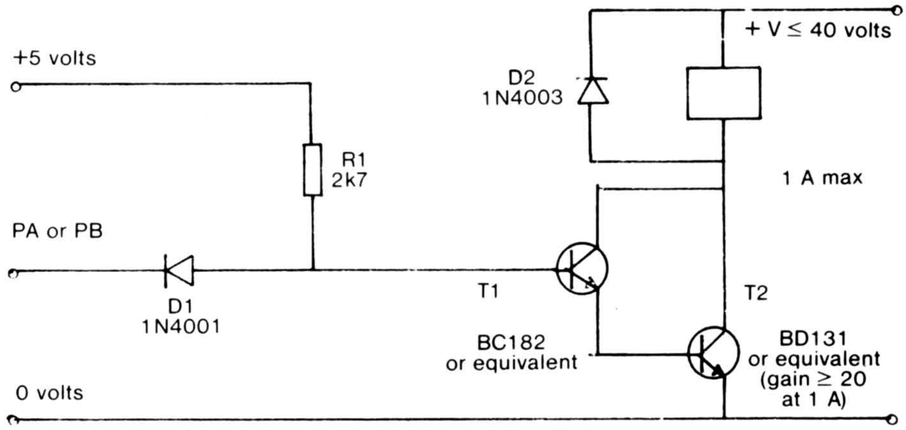

Figure 7 – Darlington pair circuit for higher current switching

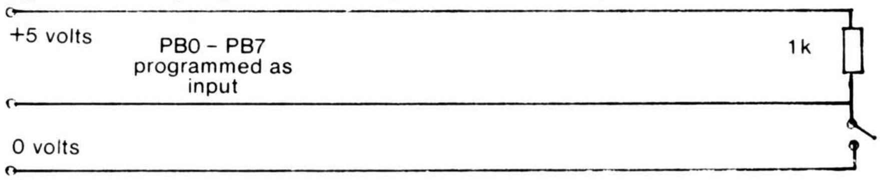

Figure 8 – Simple switch input to user port

USING THE PORTS AS INPUTS

The most important thing to be sure of when using the ports as inputs is that you vave actually programmed them into the input mode. If you have programmed them as outputs and then try to use them as inputs you may well blow them up. Also, as I have said, PA has output buffer circuits on it and can therefore not be used as inputs at all. It is worth noting at this point that when you first switch the machine on, or press the BREAK key, PA is automatically set in the output mode, and PB in the input mode.

Simple inputs can be provided by using mechanical switches or reed switches which can be operated by bringing magnets near them. The switch can be connected directly between the input port and 0 volts so that when it is pressed the computer registers a logic 0. Unfortunately you can't get it to work the other way round by connecting between the port and +5 volts since inside the input port is a resistor pulling it up to +5V so that if left unconnected it registers logic 1.

READING AN INPUT PORT

In order to read an input port, you can again use byte indirection, though this time it appears on the other side of the assignment, viz:-

```
value + ?&FE60
```

This is equivalent to "value = PEEK(&FE60).

But what if you want to look at one particular line and are not interested in, or don't know the value of the other lines? For this we can use the logical operator, AND. For example, to check on the state of PB3, we could say:-

```
IF(?&FE60 AND 8) = 8 THEN
PRINT "ON" ELSE PRINT
"OFF"
```

or, to wait for PB1 to go to logic 0 we could say:-

```
REPEAT
UNTIL ?&FE60 AND 2 = 0
```

APPLICATIONS

I hope you now feel that you could go away and start connecting up to say a model railway or model car racing set. You have enough information to be able to switch motors on and off and also to look at reed switches or mechanical switches to sense the presence of a car or a train. We haven't thought about how to actually control the speed of a motor yet, only how to switch it on and off, but first things first!

COMMENT

A question I am frequently asked is, "Which segment of the electronics and computing market does our magazine appeal to?" By arranging readers into neat categories, media analysts hope to be able to divide markets into segments. This quite normal practise works fine when dealing with traditional industries such as mechanical and electrical engineering. It is not usual to find a mechanical workshop technician or machine operator with a full-blown lathe or milling machine in his back kitchen.

In the case of a computer service or electronics technician, we are not surprised to learn that after leaving his computer system at work he returns home to a lavish and possibly better computer in his own lounge. A recent example which illustrates this point arose from a telephone conversation I had recently with an E&CM reader, who phoned from his office to discuss a product review. The item we discussed would clearly be defined as "business use" however, the link between the professional and private interest of this reader were inseparable. He went on to tell me how at home he has a dustbin lid covered with silver paper on his garage roof which forms part of a satellite base station.

Since I know from our survey that this particular gentleman is by no means untypical of E&CM readers you can imagine the headaches we have trying to explain our reader profile to professional media agencies.

In an effort to try to put computer users into slots, computer manufacturers are now placing different emphasis on the words 'personal' and 'home' computer. When Sharp first introduced their MZ80B Personal Computer, I thought they were mad restricting its use by the title to personal computer users, when the specification clearly made it suitable for professional users. It soon became obvious however, that Sharp were aiming at the managers, engineers and decision makers who could justify a personal computer on their desks.

The distinction then, between different levels of micros would appear to be 'home computers' which fall into the price bank of up to say £500. Followed by 'Personal Computers' which normally cost between £500 and £3000 and finally 'Business Computer Systems' which carry a price tag anywhere between £3000 and £20,000 depending on the software requirements.

Survey 82

During the past month I've been wading through the surveys kindly completed by readers and they reveal some surprising results. In particular was the amount of cash many of our readers earn which has prompted a memo from me to our Chairman asking for a 300% pay increase to bring me into line with the lowest paid readers. "I didn't know we were paying you anything", Chairman. According to your figures and a slight bit of extrapolation E & CM readers will be spending a massive 14½ million pounds on electronics and computing equipment during the next twelve months. In addition 34% of you influence capital equipment purchasing and 20% have a budget to spend at work. An estimated 37% of our readers plan to buy another computer shortly and 62% use computers at work.

One of the less predictable areas of the survey was readers alternative interests to electronics and computing. I won't dwell on this since its a personal matter and what people do in their spare time is their own business. If I tell you in some confidence however, gardening, sex, home brewing and amateur radio are in some way linked in the minds of some of our readers then perhaps you will know what to make of it.

My conclusion to date is that we are reaching probably the most influential, technical sector of the electronics and computing market and with the information you have provided I hope we can now plot a course for an editorial balance which continues to meet the requirements of a great many electronics and computing enthusiasts.

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This project describes how the 80/81 can be easily expanded beyond the addition of a 16K RAM pack.

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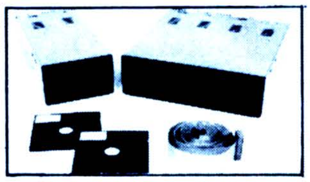

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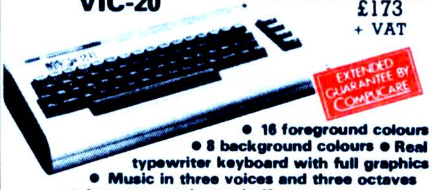

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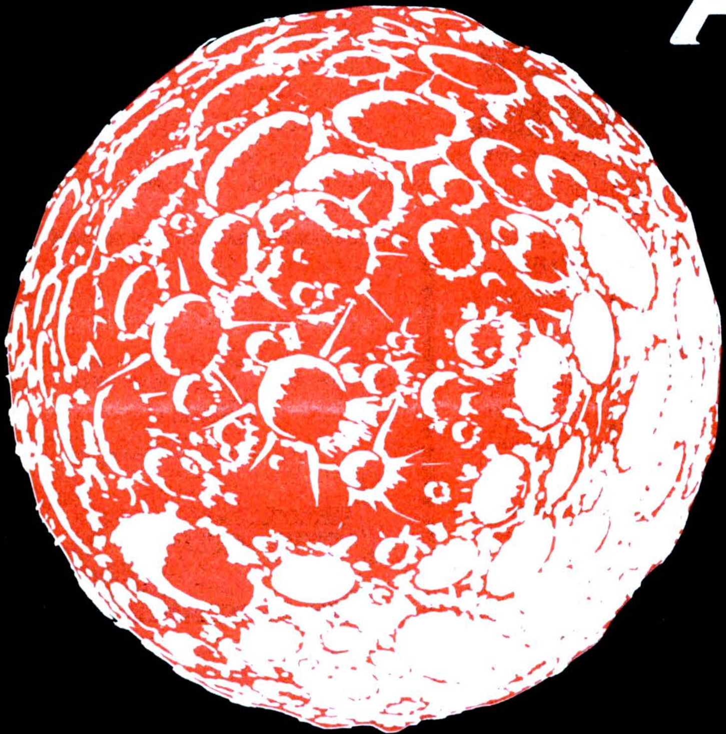

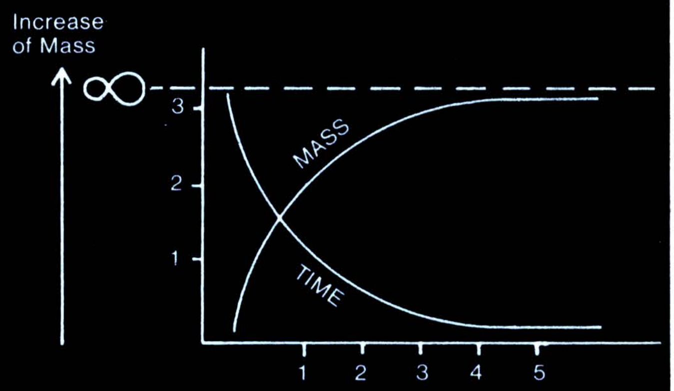

By ROGER DAVIS

Will it ever be possible to travel to the stars within a tolerable period of time?

On the face of it the answer would appear to be no.

The nearest star to our sun is Alpha Proxima which is a mere 4.2 light years distant. A light year is the distance that a light wave will travel in one year, and this puts our closest neighbour a staggering 24.636 Trillion (10^{12}) miles from us. The fastest a space vehicle has managed so far is 80,000 mph for the voyager spacecraft on its way from Jupiter to Saturn last year.

Even if we could accelerate up to 1 million miles an hour it would still take 2,810 years to reach Alpha Proxima.

There have been futuristic proposals of astronauts put into suspended animation, or of self replicating colonies which would travel on for generations until the fiftieth or sixtieth grandchild would arrive at the star. It doesn't seem at all realistic and the people who have suggested it cannot have seriously thought such a scheme through. In any case we are interested in more stars than the handful which are just a few light years from us. What about the ones 50, 100 or even more away. Our own milky way galaxy has 10,000 million stars in it, and is 100,000 light years in diameter.

If we are ever going to visit the stars there has to be another way.

And there just may be.

The answer could lie in Elbert Einstein's Theory of Relativity and its effect on matter which is travelling at very high speeds relative to an observer.

It has now been shoen by numerous observations, and repeatable experiments that the 'Time Dilation' effect revealed in the equations of the 'Special Theory of Relativity', would appear to indeed by a reality.

For example:-

★ When two previously synchronised atomioc clocks are compared after one of them has been taken for a ride in a jet aeroplane at 600 mph there is a measurable difference between their two times as accurately predicted by the theory.

★ Time as measured in a satellite, orbiting the earth at 10,000 mph slows down by a measurable amount relative to the time on earth.

★ Atomic particles which decay into other forms in a precise interval of time have their lifetimes extended when travelling at speeds close to the speed of light.

To test out the time dilation effects of the theory of relativity we have devised a fairly simple computer program to calculate the effects on an interstellar journey which we imagine future space explorers will be able to undertake.

The results should give a valuable insight into what our great great grandchildren will be capable of and also reveal some of the astonishing consequences inherent in Einsteins equations.

The year is 2182.

The solar system has been colonised by earth people and there are now settled communities living on Mars and the Moon. Orbitting around the earth there are huge space islands and it is from here that interstellar expeditions are planned and launched.

Technology has advanced in the 200 years since our time by at least as much as ours has from 1782. In particular rocket motors have been developed out of all recognition to anything we know today. We can only guess at their means of propulsion, perhaps it is an atomic rocket, perhaps an ion rocket. We only know that the power to weight ratio and the ability to generate a constant thrust for very long periods of time is far in advance of anything we can achieve today.

It is planned to launch an expedition to a nearby star and in order to do this we must first of all calculate:

(1) The life support systems to sustain the crew over the period of the expedition, in their reference time frame.

(2) The period away from earth, in earth's reference time frame.

(3) The power requirements for the rocket.

LET: K = Distance to the star. In Light Years.

J = Seconds per year. i.e. 31.536×10^6.

L = Time on board the rocket. In years.

t_e = Time back on the earth. In years.

v = Velocity in metres per second.

c = Velocity of light. i.e. 3×10^8 metres per second.

From the Lorentz transformations as adapted by Einstein:

Time away fro earth (t_e) $= \frac{LJ}{\sqrt{1 - v^2/c^2}}$ seconds

Where the Lorenz transformation (G) is the term $\sqrt{1 - v^2/c^2}$

Therefore, $t_e = GLJ$

The distance travelled by the spacecraft must therefore be: $t_e\,v = GLJv$ metres.

But the distance from the earth to the star is: KJc metres.

Therefore, KJc = GLJv.

$$\text{Hence, } Kc = \frac{Lv}{\sqrt{1 - v^2/c^2}}$$

$$\text{and } K^2 c^2 = \frac{L^2 v^2}{\sqrt{1 - V^2/c^2}}$$

From this equation we can extract the spacecraft velocity v.

Thus, $v = \frac{K}{\sqrt{L^2 + K^2}} \times c$ metres per second.

To calculate the time away from earth (in earth time) we now simply divide the distance to the destination by the velocity and add on the time we spend there.

Time away from earth = K/v + M years. Where M = time at destination.

One important consequence of travelling close to the speed of light (and incidentally a severe limitation on our present technology to achieve these speeds) is the exponential increase of mass the faster we go.

This is calculated by multiplying the inertial mass of the spacecraft by the Lorentz transformation, G.

Mass increase due to relativity = W x G tons. Where W = inertial mass.

The computer program listed here is called STARTRIP and works out all the above equations.

It was written in MicroSoft Basic and so should be easily adaptable to most other Basic dialects. It is very 'user friendly', and alos quite amenable to added refinements, such as calculating more precisely the effects of the four periods of acceleration and deceleration.

The program, as it is currently written, only calculates relativistic effects during the long cruise periods at speeds close to the speed of light. The periods of accelerate, decelerate on the outward journey and accelerate, decelerate on the homeward journey have not been worked on for relativistic effects. Time during these periods is assumed to be earth time and since the speeds during most of them will be well below the speed of light this is a reasonable assumption.

The graph showing the exponential nature of time dilation and mass increase further illustrates this point.

Another possible refinement is to calculate the effect of different amounts of accelerating force.

A constant, uniform acceleration, of 15 metres/sec2 (i.e. approximately 1.5g) was assumed as being the highest level the astronauts could tolerate over a period of a few months. At this level it takes 7.61 months to reach speeds close to the speed of light and a similar period to slow down again to the speed of the star system to be visited, or to earth-bound levels on the return journey. At 1.5g everything would weigh 50% more to the astronauts so it must come as a welcome relief when the required speed is reached and the rocket motors are switched off. The spacecraft will then cruise along with a constant momentum at this speed, (for ever if necessary) and the astronauts will experience the joys of weightlessness. 7.61 months from their destination they must switch the motors on again, this time pointing in the reverse direction, in order to synchronise their speed with that of the star system they are visiting.

Since the stars in our Milky Way Galaxy are not speeding away from each other, in the same way as the galaxies themselves are thought to be doing, it seems a fair assumption to make, that both our earth and the star system to be visited are moving at about the same speed. However, simple refinements to the program could take into account any relative movements between source and destination.

The minimum memory required is about 8K, but again it could easily be tailored to less by cutting down on the verbiage somewhat.

Double precision calculation has had to be used to achieve the fine accuracies necessary as the speed of light is approached, but even so the explorers are limited by the accuracy of the computer to our own Milky Way Galaxy. The machine cannot cope with distances greater than 99,999 light years from earth. If your computer cannot handle double precision calculations you will probably be confined to star systems around 40 to 50 light years away.

```
10 PRINT CHR$(4)
20 PRINT TAB(20) "A JOURNEY TO THE STARS"
30 PRINT:PRINT
40 INPUT "WHAT IS THE DISTANCE TO THE STAR IN LIGHT YEARS, PLEASE.... ...",K
50 INPUT "NUMBER OF YEARS THE ASTRONAUTS WANT TO SPEND ON THE ROUND TRIP ?..",L
60 INPUT "HOW,MANY MONTHS WILL THE EXPEDITION REMAIN AT THE DESTINATION...",M
70 N = L - (M + 30.44)/12
80 REM 30.44 MONTHS IS 2 ACCELERATION PERIODS AND 2 DECELERATION PERIODS.
90 V = K/SQR(N*N + K*K)
100 PRINT:PRINT
110 PRINT "THE RESULTS OF THE CALCULATIONS ARE AS FOLLOWS:--"
120 PRINT
130 PRINT "TO ACCOMPLISH THE JOURNEY IN"L"YEARS"
140 PRINT "A CONSTANT VELOCITY OF" V*671.1 "MILLION MILES PER HOUR"
150 PRINT "MUST BE MAINTAINED FOR" N   "YEARS."
160 PRINT "THIS REPRESENTS A SPEED OF" CDBL(V)"C METRES/SECOND,"
170 PRINT "OR" CDBL(V)*100 "% OF THE SPEED OF LIGHT."
180 G = 1/SQR(1 - V*V)
190 PRINT "TOTAL DURATION, IN EARTH TIME =" (2*K/V)+M/12 "YEARS"
200 PRINT:PRINT
210 INPUT "DO YOU WISH TO INVESTIGATE THE ROCKET POWER REQUIRED.?.YES/NO...",N$
220 PRINT
230 IF N$ = "YES" THEN 240 ELSE 350
240 PRINT "THANKYOU"
250 PRINT "WHAT IS THE MASS OF YOUR SPACECRAFT AT ZERO SPEED ?"
260 INPUT "CHOOSE BETWEEN 1 AND 10 TONS...",W
270 PRINT
280 PRINT "With a Physically tolerable, constant acceleration"
290 PRINT "of 1.5g 'the spacecraft will reach a velocity close to c"
300 PRINT "in 7.61 months, earth time."
310 F = W * 5280 * 48 'INITIAL THRUST
320 PRINT "INITIAL THRUST =" F "lbs."
330 PRINT "THIS RISES TO =" F * G "lbs. AT THE MAXIMUM VELOCITY."
335 PRINT "THE MASS OF THE SPACECRAFT INCREASES TO" G*W "TONS."
340 PRINT
350 PRINT "THANKYOU.....AND BON VOYAGE."
360 END
```

(Continued from Page 24)

INPUT AT, on most civilised systems, stops the cursor at the point on the screen specified. So when the user of the program starts typing, the answer appears at the point where the question was asked.
Not on this one. INPUT always produces a prompt on the bottom line, whether INPUT AT or not.

INVERSE Like the colours, INVERSE is a bit tricky to manage — it switches the INK and PAPER status round. The problem is to work out how much of the screen will be affected. Sometimes, it is just the character blob: other times, it's the whole graphics area.

LOAD See tape handling, above.

MERGE More tape handling, above.

MOVE Disk command.

OPEN# Disk command.

OUT Gives direct control over the wires at the back of the computer. Anybody designing a machine control system will be glad of this.

OVER Should somebody one day put the language APL on the Spectrum, he will be glad of this, because APL uses overprinting — one character on top of another — and this will allow it. Put a double quote on top of an 0 and you get an Umlaut, says the manual. I got a wonky rabbit, but I'm sure my German friends wouldn't mind.

PAPER See INK.

PLOT Before buying a Spectrum, it would be a good idea to see somebody do some Plotting. As long as you stick to monochrome plotting — that is, without changing paper and ink colours throughout the operation, Sinclair's claim is quite true.
Sinclair says that his machine is superior to the BBC micro, because his hi-resolution graphics use less memory. So, he says, when you use high resolution graphics, on a BBC Model A, you only have 3 Kbytes of memory left for your program. This is true enough — but it implies that his hi-res graphics are the same as the BBC graphics, and they certainly are not.
Apart from the problem of going "off the screen" mentioned above, there is the question of how versatile they are. And the Spectrum graphics have an inherent limitation, in that there can be only two colours in any character square — the ink colour, and the paper colour.
Any square can have any individual pixel set to the paper or ink, so the fine detail possible is good. But take a red line, and cross it over a black line, and the square where they cross will become confused. Draw several intersecting lines, and you end up with blobs instead of pixels.
With care, the attentive screen designer can get around these — but on the BBC machine and on the Commodore VIC, the attentive designer doesn't have to bother.

PRINT Yes, there was a PRINT on the ZX81, but there are significant differences in this new Basic. Mainly, these are due to the fact that the new machine doesn't use the unique codes of the ZX81, and uses American Standard Code for Information Interchange (Ascii) instead. So there are "control" characters, which have control effects on the screen. A single quotation mark produces a line feed and carriage return. And colour items produce colour changes.

READ This, like the next keyword, goes with the DATA statement.

RESTORE With a number, starts READing at the numbered item. Otherwise, works as in all ordinary Basics.

SAVE See tape handling notes, above.

VERIFY See tape handling.

User impressions

The new keyboard is made of rubber, and it squishes. Whatever colour the keys eventually are, I think you will need good light and good eyesight to read the characters in red on the keys themselves. They are little, fiddly characters like the equals sign, the commas, colons, multiplier, minus, < > and so on. The layout is logical enough. Start a command like PRINT, and you will find the quote makes on the same key as the PRINT command. The often needed semicolon is right next to it. Similarly LET and = are on the same key, THEN and GOTO are on the G key, FOR and TO on the F key with STEP next to them on the D key.

To say that the keyboard is "typewriter pitch" is to mislead. Yes, it is, but the space bar is missing, the ENTER key is where you expect a semicolon, comma and full stop are SHIFT characters on N and M, and anyway, you have to press the keys in the middle to be sure that they register. It's a great improvement on the ZX81, but that's all I can really say for it.

Display

Prototypes, says Clive Sinclair, are not as good as the production models — the fault which made the colours shift and shimmer like a mirage in the Sahara will be cured by reducing the bandwidth of the colour. In fact, this will reduce, not eliminate, the "dot crawl" problem, and the colour will never be capable of display on a high quality monitor to ultra-high resolution like the BBC micro. Then again, for £125 what do you expect?

Basic

It's a noticeable improvement on ZX81 Basic. That was pretty good. I don't think the speed of Basic matters too much to most people, which is just as well for the Spectrum. The only thing slower is a Casio pocket Basic calculator, or the ZXC81 in SLOW mode. In FAST mode, the ZX81 beats it comfortably. And any model BBC micro is between four and ten times faster, judged on the standard benchmarks originally published in Kilobaud. I wouldn't mention this, but Clive did say his machine was "more powerful" than the BBC.

The BBC micro has a built-in assembler. It runs slowly, but it runs. This machine has no assembler.

The Manual

Better than average despite some excruciating puns by Steven Vickers, which escaped the censor. Some were quite nice — comparing strings, for example, Vickers asks "Which of these is the lesser? EVIL or evil?"

It certainly is better than the BBC manual was, though the new BBC manual will be out by the time you read this, and it may even include all the functions of the machine.

General

It is terrific value for money. At the moment, there is so much more software available for the Commodore VIC that I think the non-curious customer might prefer that machine — but within six months, that will change and the Spectrum will (I think) have the edge.

Once it has its diskette drives, however, there won't be anything in the world to touch it. And somebody will put CP/M on it, you'll see.

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PRINTERFACING THE ATOM

by Tim Edwards

If you were buying a printer specifically for the Atom then you would obviously choose one with a Centronics parallel interface, but supposing you have access to a different type of printer how would you link it up to the Atom? In this, the first of two articles, I shall look at the general principles of how to set up your own interface and replace the Centronics routine with a suitable routine to run that interface, be it serial or parallel. The example given in this article, to illustrate these principles, is the Qume Sprint 5. Then in next month's article I shall describe the more complex system necessary to link up to a Commodore printer which uses the I.E.E.E.488 interface.

OUTPUTTING CHARACTERS

Whenever you write a character on the screen and/or to a printer, either in direct mode from the keyboard or in a program, the Atom executes a JMP(WRCVEC). In other words it looks at locations #208 and #209 to find the **WR**ite **C**haracter **VEC**tor, which is the start address of the routine to which this character should be sent. This is illustrated in figure 1. If you wish therefore to add your own routine, you need first to change WRCVEC to point to the start of your routine, and then at the end of your routine, jump back into the Atom's own routine.

It is worth mentioning at this point that normally WRCVEC points to #FE52, but if you are using the Wordpack r.o.m. then a different routine is used for outputting characters, which starts at #ACCE. Therefore the best thing to do is to have an initialisation routine which removes the present value of WRCVEC and stores it for later use and replace it with your own WRCVEC. Then at the end of your own routine you execute a JMP(OLD WRCVEC). This is illustrated in figure 2.

What has to go into your special printer routine?

The sample routine, which is for the Qume Sprint 5, is given in Appendix A and will be referred to in the following explanation by using the BASIC line numbers.

1) Initialisation (lines 40 – 80)

Remove the old WRCVEC and replace it with a pointer to the start of your routine, set up the VIA appropriately at output, and send out a carriage return to check that the printer is responding.

2) Write a character routine (lines 90 – 280)

Lines 90 to 180 is the routine used to output a single character to the printer. The main part of the routine consists basically of saving all the registers (line 190), dealing with the individual character, first checking to see if it is a control code (lines 220 – 280), and then restoring the registers before jumping back into the Atom's own routine (line 210). The way in which the individual character is dealt with is shown in the form of a flow chart in figure 3. If a control B or C is detected, it must not be sent on to the Atom routine or it will think that there is a Centronics printer attached and wait for the appropriate response which will not of course be forthcoming. Therefore these control codes are replaced with either a null (0) or an ESC (27) before passing on to the Atom routine.

Another point to note is that some printers have an auto-linefeed. In other words they respond to a carriage return (13) by executing a carriage return and a line feed. To cope with this the Atom uses memory location #FE to store a "character not sent to the printer", and on BREAK this is initialised to a linefeed character (10). So all you have to do is to compare the character with the contents of #FE and, if equal, not output it to the printer (line 270). This then suppresses all linefeed characters as far as the printer is concerned, but if you should want to send out a linefeed character, all you have to do is to alter the contents of #FE, send out the linefeed and then restore #FE to a linefeed character.

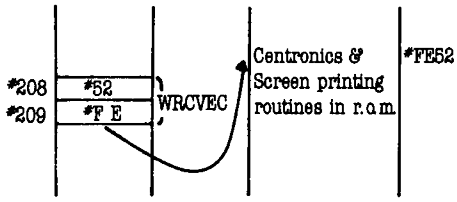


Figure One Illustration of JMP (WRCVEC)

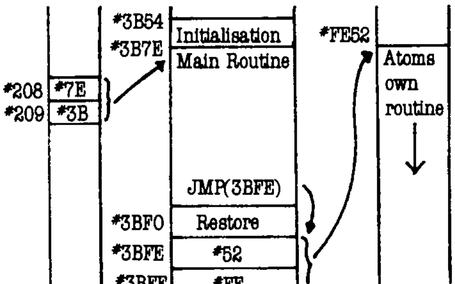


Figure Two How new printer routine is fitted into existing routine

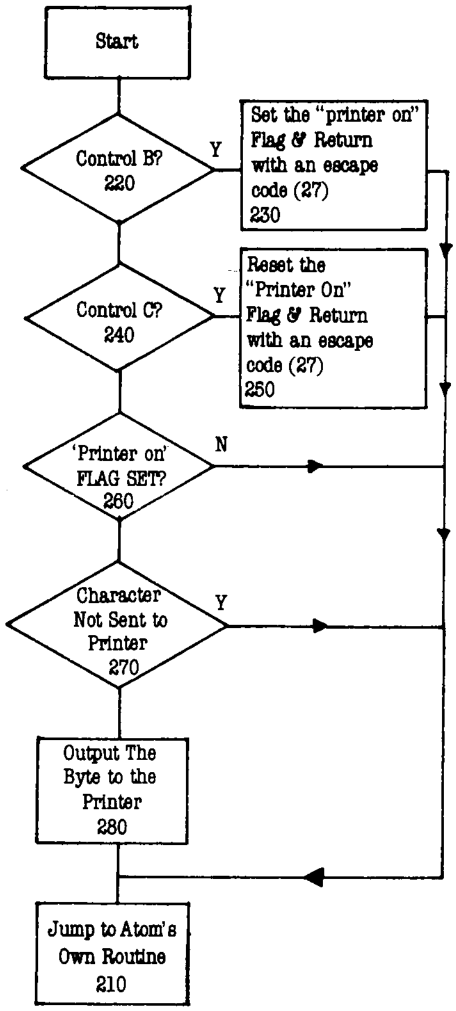


Figure Three Flow Diagram of Characters Handling Routines

DOT-BY-DOT SCREEN DUMP

The routine for producing a dot-by-dot screen dump of the high resolution graphics screen is given in Appendix B. It sends out spaces or full stops according to whether each bit in the video ram is clear or set. If a whole byte is zero then instead of sending out eight individual space characters, it sends out the control codes which make the printer spacing eight times what it was previously, and then just sends out one space character. Since it takes three characters to change the print spacing this is not much of a saving for a single zero byte, but in practice large areas of the screen may well be clear, in which case you get a succession of zero bytes and only need to change back to the narrow spacing when you come to the first non-zero byte.

To run the routine use LINK #3B0B from within a BASIC program, or JSR #3B0B from a machine code program. A routine is also provided so that you can initiate the screen dump with an interrupt. To set this up, you have to do a LINK or JSR #3B00 which sets the interrupt vector to point to the interrupt routine at LL14. Then when you momentarily ground the IRQ line, all the registers are saved, the screen dump routine is run, and the registers are restored. Therefore when the screen dump is finished, the program continues as if nothing had happened. It would be a good idea when using this routine to run the interface at the full 1200 baud, because even at this speed it can take 5 minutes or so to do a full screen dump. A sample dump is shown in figure 5.

INTERFACING TO THE QUME SPRINT 5

In order to drive the Qume Sprint 5 using the routine in Appendix A, you will need an MC1488 or SN75188 to produce the RS232 drive requirements. This chip uses dual supplies, but the voltages are not too critical. Anywhere between 9V and 12V will do, so you could use a couple of 9V dry batteries. The connections are shown in figure 4. The "data terminal ready" line is sensed by the Atom to check whether the Qume's input buffer is full, and is only really necessary if you are using the full speed of 1200 baud. The baud rate is set to 1200 baud by the LDX@14 at LL13. For 600 baud use LDX@33, 300 baud would be 65, and 110 baud would be 180.

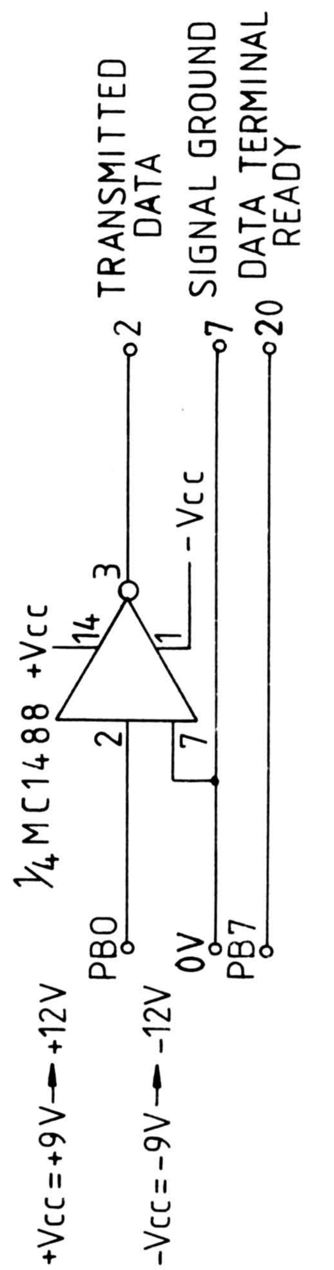


Figure Four RS 232 Interface

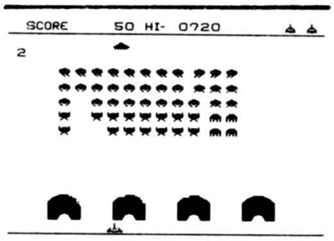


Figure Five Example of a dot-by-dot printout of the Atom's high resolution screen

NEXT MONTH: How to interface the Atom to a Commodore Pet printer.

Appendix B Dot-By-Dot Screen Dump Routine

```
 10 I=#3B54;M=#3BFC;B=#B800;V=#208
 20 DIMLL8;FORN=0TO9;LLN=#FFFF;N.
 30 P.$21;FORN=1TO2;P=I;[
 40:LL0 LDAV;STAM+2;LDAV+1;STAM+3
 50     LDA@(LL5%256);STAV
 60     LDA@(LL5/256%256);STAV+1
 70     LDX@1;STXB+2;DEX;STXM+1
 80     LDA@13;STAM;JSRLL1;RTS
 90:LL1 LDX@0;STXB
100     LDAM;ORA@#80;LDX@10
110:LL2 JSRLL3\delay routine
120     SEC;RORA;ROLB
130     DEX;BNELL2
140     RTS
150:LL3 PHA;TXA;LDY@10
160:LL4LDX@14;DEX;BNEP-1
170     DEY;BNELL4
180     TAX;PLA;RTS
190:LL5 PHP;STAM;TXA;PHA;TYA;PHA
200     BITB;BPLP-3;JSRLL6
210     PLA;TAY;PLA;TAX;LDAM;PLP;JMP(M+2)
220:LL6 LDAM;CMP@2;BNELL7
230     LDA@128;STAM+1;LDA@27;STAM;RTS
240:LL7 LDAM;CMP@3;BNELL8
250     LDA@27;STAM;LDA@0;STAM+1;RTS
260:LL8 BITM+1;BMIP+3;RTS\printer on?
270     CMP#FE;BEQP+5
280     JSRLL1;RTS
290];N.;LINK I
300 P.$6$2"INITIALISE"&I'"BYTE O/P"&LL1'
310 @=5;P.$3" *SAVE QUME"&I,&P,&I
320 END
```

Appendix A Printer routine for a Qume Sprint 5

```
 10 L=14;M=#85;Q=#80
 20 V=1;H=2;REM vert. & horiz. spacing
 30 V=V+1;N=H+1;W=8*H+1;B=#B800
 40 DIMLLL;FORC=0TOL;LLC=#FFFF;N.
 50 P.$21;FORC=1TO2;S=#3B00;P=S;[
 60     LDA@(LL14%256);STA#204
 70     LDA@(LL14/256%256);STA#205
 80     RTS
 90:LL0 LDX@192;LDY@1;STYB+2
100     DEY;STYQ+2;LDA@#80;STAQ+3
110     LDA@32;STAQ;LDA@27;JSRLL8
120     LDA@30;JSRLL8;LDA@V;JSRLL8
130     LDA@N;STAQ+4;JSRLL7
140:LL1 LDA(Q+2),Y;STAQ+1
150     CMP@0;BNELL3
160     LDA@W;CMPQ+4;BEQLL2
170     STAQ+4;JSRLL7
180:LL2 LDA@32;JSRLL8;JMPLL5
190:LL3 LDA@N;CMPQ+4;BEQP+7
200     STAQ+4;JSRLL7
210     TXA;PHA;LDX@8
220     LDAQ+1;PHP
230:LL4 LDA@32;PLP;BPLP+4
240     LDA@46;JSRLL8
250     ASLQ+1;PHP
260     DEX;BNELL4
270     PLP;PLA;TAX
280:LL5 INY;PHP;DECQ;BNELL6
290     LDA@13;JSRLL8;LDA@32;STAQ;DEX
300:LL6 PLP;BNEP+4;INCQ+3
310     TXA;BNELL1
320     LDA@27;JSRLL9;LDA@26;JSRLL9
325     LDA@73;JSRLL9;RTS
330:LL7 TXA;PHA;TYA;PHA
340     LDA@27;JSRLL9;LDA@31;JSRLL9
350     LDAQ+4;JSRLL9
360     PLA;TAY;PLA;TAX;RTS
370:LL8 STAM;TXA;PHA;TYA;PHA
380     JSRLL10;PLA;TAY;PLA;TAX;RTS
390:LL9 STAM
400:LL10BITB;BPLP-3;LDX@0;STXB
410     LDAM;ORA@#80;LDX@10
420:LL11JSRLL12\delay routine
430     SEC;RORA;ROLB
440     DEX;BNELL11
450     RTS
460:LL12PHA;TXA;LDY@10
470:LL13LDX@14;DEX;BNEP-1
480     DEY;BNELL13
490     TAX;PLA;RTS
500:LL14TXA;PHA;TYA;PHA
510     JSR#FD1A;JSRLL0
520     PLA;TAY;PLA;TAX;PLA;RTI
530];N.;@=5;P.$6"ROUTINE STARTS AT #"&LL0'
540 P." *SAVE SDUMP"&S,&P,&LL0'
550 END
```

Transformer & Line

By Ralph Lovelock

The transformer is often used in networks of the types covered, and it seemed highly desirable to include such a section. To completely define a transformer would require a complicated circuit due to the effect of stray inductance and capacitance. These factors however are very difficult to measure in isolation, and in any case are likely to vary from unit to unit wound from the same design. It is fortunate therefore that they only seriously affect results at the top end of the frequency band covered, and because of production variations in their values, it is good practice to design the physical lay-out so that the major effect lies just outside of the band covered and may normally be ignored.

In Fig. 5.1 is shown the major equivalent used to account for copper losses, winding self-inductance, and leakage inductance between the two. In Fig. 5.1 (a) the location of these values, both in the physical unit and in the Z array are shown. The schematic circuit shows the equivalent circuit used for computation of the matrix. In (b) is shown the Z matrix for this equivalent which is a single tee circuit such as was used in the previous article. The Z matrix is used here because memory space is minimised for computation, and in (c) is shown the standard conversion formula between Z and A together with the resulting equations for computing the matrix shown for use in the program.

In the listing shown lines 2200 through 2245 compute the values and assemble them into a matrix for return to the calling program. This matrix will cover only the major portion of the transformer, but the iron losses and self capacitance of each winding must be covered by a second matrix of the 'CR' type 7 added as second matrix across the windings by matrix multiplication as already covered in earlier articles. Unless the upper edge of the frequency range is important, a single additional matrix of this type will suffice, but if the edge of the range is vital, where the value of the coupling factor begins to give a drooping characteristic, then two matrices of type 7 should be added, one at the input covering the primary self capacitance and the iron losses, and a second at the output covering secondary self-capacitance and any stray ohmic losses which can be measured on a few production items.

The only secondary factor not covered will be the capacitance between the two windings, and if this is vitally important, then it can be covered, providing equipment is available to measure it, by use of an unsymmetrical form of bridged tee filter adapted from the symmetrical form in the last article, together with two type 7 sections added on either side of the main matrix. If there were to be a desire for this expressed by readers, such an additional section could be published involving an expansion of the Y array, and addition to some other portions of the program.

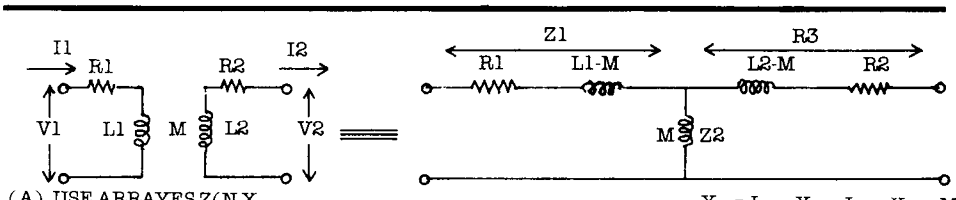
The normal transmission line is often used as a filter, as a matching unit, and as a delay line, as well as the normal method of conveying communication from one location to another. It comprises a complete ladder network in its own right, and can be simulated over a limited frequency range by a set of sections comprised of normal impedance nets in series. The line itself has a distributed impedance instead of a succession of local ones, and where the coverage of a wide frequency range is required it is essential that the whole length shall be of uniform distributed values. This is usually catered for by fairly expensive cables manufactured to very close tolerance.

Since there are some uses where a line is inserted as a part of a series of ladder networks, it was thought desirable to include it in this suite. It should be realised however that all the values used in the computation should be the 'effective' values as measured on a high accuracy bridge, and not the approximate calculated ones. This applies particularly to the length, which in most cases will be different from the physical length of the cable used.

The computation involves a new type of complex trigonometrical functions, called 'hyperbolic' because they were first used for calculations involved with the hyperbola. Fig. 5.2 shows the complete details of the line computation used here, and (c) covers the relationships used for calculation. This is listed as a small separate subroutine, since although tables are readily available for the functions of real values, they are inconvenient to use for functions of the 'complex' values involved in electrical circuits, and it may be desired for other purposes to have available a quick and easy way of obtaining such values. The listing of this sub-routine is contained in lines 1600 through 1650.

In the figure (a) shows the data values required and their location within the Z array, while (b) shows the formulae for calculating the 'characteristics' which are required for computation. These characteristics are the values normally used for quality control of production. A second subroutine, in lines 1700 through 1750 gives a straight-forward routine for obtaining them, and is given here as a separate routine since it might well be desired to obtain them for other purposes.

The matrix for the line is given in (e) while (d) covers the question of the 'signs' to be used for the A and B arrays when using these relationships. The non-mathematical reader need not bother about these details, since the program automatically sorts this out, but they are given for those who wish to follow exactly what the listing is doing. It commences by calling up the routine to



(A) USE ARRAYES Z(N,X_{1-10}) $X_1 = L_1$ $X_3 = L_2$ $X_5 = M$ $X_2 = R_1$ $X_4 = R_2$

CU Losses are accounted for in the matrix, but iron losses and winding self capacitance are best covered by the product with a second matrix of shunt impedance types 6 & 7.

(B)

$$Z = \begin{vmatrix} Z_1 + Z_2 & -Z_2 \\ -Z_2 & Z_3 + Z_2 \end{vmatrix} = \begin{vmatrix} R_1 + JWL_1 & -JWM \\ -JWM & R_2 + JWL_2 \end{vmatrix}$$

$Z_{11} = R_1 + JWL_1$
$Z_{12} = -JWM$
$Z_{21} = -JWM$
$Z_{22} = R_2 + JWL_2$

(C)

$$A = \frac{1}{-Z_{21}} \begin{vmatrix} Z_{11} & |Z| \\ 1 & Z_{22} \end{vmatrix}$$

$A_{11} = \dfrac{R1 + JWL_1}{JWM}$

$A_{12} = \dfrac{(R_1 + JWL_1)(R_2 + JWL_2) - W^2M^2}{JWM}$

$A_{21} = \dfrac{-1}{JWM}$

$A_{22} = \dfrac{R_2 + JWL_2}{JWM}$

FIGURE 5-1 TRANSFORMER

obtain the characteristics, then the routine for obtaining the hyperbolic functions from these values, and finally assembles these into the array.

This article concludes the computational algorithms used to obtain the results defining the performance of a complete network from the component values entered. The remaining articles will cover the use of these calculations, such as the entry of values, the outputting of results as a table of values and two curves showing the variation of amplitude and phase angle over the frequency range covered. It seemed time therefore to give preliminary details of the general arrangement, so that readers who desire to use some of them before the series is finished, may have some guidance along these lines.

In Fig. 5.3 is shown the general arrangement of sections by type throughout the suite, and will show the possibly perplexing reason why those sections already given show such a wide variation of line numbers. It seemed desirable to explain in some detail how each of the algorithms worked, one at a time, so that the assembly into a complete set could be followed without having to divert attention as to what each section was doing. It seemed desirable however to allocate discrete blocks of nubers to specific types of function, so that when assembled, it would not be a haphazard search to find any particular part of the overall computation which one wished to examine. The next article will cover input of values, since once this routine is entered, any of the algorithms may be immediately and quickly used by means of a custom-built temporary routine in section 8000.

For guidance, should this be done, and for future reference, Fig. 5.4 shows schematically, but not in detail, the general logic to be employed in the further development of this suite. In future articles the detail of the subroutine calling will be shown, but this is so involved that it could not be shown on a single sheet, and the figure is intended to show the overall logic employed.

For guidance to the do-it-yourself readers who desire to use some of these algorithms separately, a listing is given of a number of debugging and assembly routines which have been found temporarily useful in developing the program. Some of them will be included in modified form in the complete set of programs, but all those given here have proved of use at some stage or other of the development.

Those in the 6000 series were used to print out intermediate results when checking local performance, or when chasing a 'bug' and running it to earth. A GOTO or GOSUB statement is inserted in a gap in the program to divert the computation at the desired point. It can then be removed again when it has served its purpose. The 7000 series is concerned with machine code and USR routines. 7000 through 7070 allows trouble to be investigated in a program which has been entered in basic. At areas where it is desired to know exactly what the state of memory is, a few REM statements are inserted at locations which are to be examined. The statements are coded to allow each of them to be individually recognised.

Typical codings are:- REM INPUT INPUT INPUT, or REM FOR FOR FOR etc etc. By entering as commands the values to be scanned as LET A1 = LET A2 = and then GOTO 7000 the computer will quickly scan the area until 234 is found, and will then run on SLOW sending out onto the screen a column of values following the 234. If the stop is at one of the markers, the 234 will be followed by three such as 238 which will allow the exact location to be found. After the screen is full, and the contents have been noted, enter CONT, further entries may be seen, but if a continuance of fast scan is desired to locate a further marker, enter LET MS = 0 followed by GOTO 7050.

The routine 7100 through 7150 is a quick and convenient way of entering a section of machine code, to be called later on USR. The values of A1 and A2 should be entered as before, followed by GOTO 7100. The number of the location currently at memory will be shown on the screen, and the computer will halt while value to be entered there is keyed in. It will then display the next location, and wait for the next value to be entered, and so throughout the area designated. If this is done in an area previously preserved by a REM statement at the beginning of the basic program, it will remain undisturbed during running, and may be addressed at will. ■

Fig. 5.3. Organisation of Computations within complete suite of programs.

Scope of coverage	Lines
Specification of general variables	1 - 99
Data input and sorting to appropriate sections	100 - 149
Control of program progression	150 - 999
Complex arithmatic	1000 - 1999
Impedances and Matrices. Computation	2000 - 3999
Matrix manipulation	4000 - 4299
Output of results	4300 - 4999
Date Entry	5000 - 5999
Debugging routines	6000 - 6999
Machine code routines	7000 - 7999
Scratchpad for custom built controls	8000 - 8999

FIGURE 5.4 GENERAL LOGIC

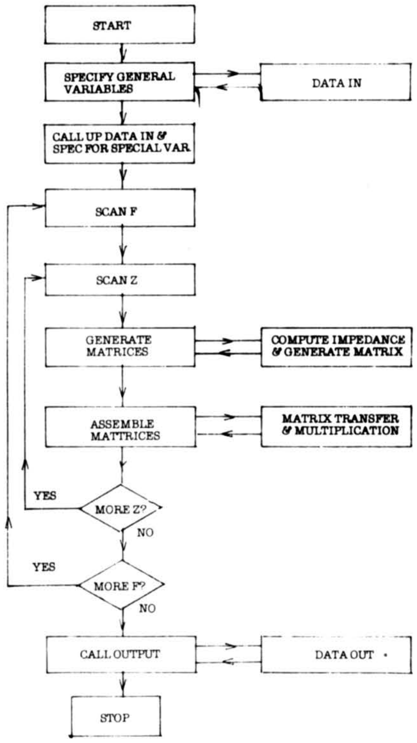
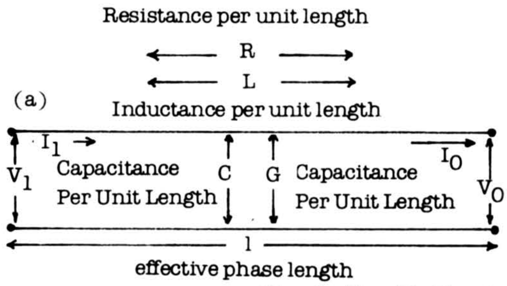


FIG. 5.2 Transmission Line



Array Z (N, X_{1-10}) $X_1 = L$ $X_3 = R$ $X_5 = 1$ $X_2 = C$ $X_4 = G$

(b) <u>Line Characteristics</u>

$Y = \beta + j\alpha = \sqrt{(R + jWL)(G + jWC)}$

$Z_0 = \sqrt{\frac{R + jWL}{G + jWC}}$

$\theta = vl$

(c) <u>Hyperbolic Identities</u>

$\text{SIHN}\ x = \frac{C^x - E^{2x}}{2} = -\text{SIHN}(-x)$

$\text{COSH}\ x = \frac{E^x + E^{-x}}{2} = \text{COSH}(-x)$

$\text{TANH}\ x = \frac{E^x - E^{-x}}{E^x + E^{-x}} = \frac{\text{Sihn}\ x}{\text{COSH}\ x} = -\text{TANH}(-x)$

$\text{SINH}(a \pm jb) = \text{SINH}\ a.\cos b \pm j\,\text{COSH}\ a.\text{SIN}\ b = \text{SINH}\ \theta = -\text{SIHN}(-\theta)$

$\text{COSH}(a \pm jb) = \text{COSH}\ a.\cos b \pm j\,\text{SINH}\ a.\text{SIN}\ b = \text{COSH}\ \theta = \text{COSN}(-\theta)$

(d) <u>Complex Arrays</u>

θ = (a ± jb = +Ax & ±Bx ; $-\theta$ = -(a ± jb) = -Ax & ∓Bx

SINH θ = SINH (+Ax & ± Bx) ; SINH $-\theta$ = SINH - (+Ax & ∓ Bx) = -SINH (+Ax & ± Bx)

COSH θ = COSH (+Ax & ± Bx) ; COSH $-\theta$ = COSH - (+Ax & ∓ Bx) = -COSH (+Ax & ± Bx)

(e) <u>A Matrix</u>

$$\begin{vmatrix} V_1 \\ I_1 \end{vmatrix} = \begin{vmatrix} \text{COSH}\,\theta & Z_0\,\text{SINH}\,\theta \\ Y_0\,\text{SINH}\,\theta & \text{COSH}\,\theta \end{vmatrix} \cdot \begin{vmatrix} -V_2 \\ I_2 \end{vmatrix}$$

$a_{11} = \text{COSH}\,\theta$

$a_{12} = Z_0\,\text{SIHN}\,\theta$

$a_{21} = Y_0\,\text{SIHN}\,\theta$

$a_{22} = \text{COSH}\,\theta$

Continued from Page 20.

the system has detected three consecutive pecks of the T-box it enters the data into storage. Figure 3 illustrates the insertion of three consecutive triplets of data values — in rows 1, 2 and 3 of the columnar tables.

Following the insertion of these sets of data the user has pecked the RESTART and RETRIEVE boxes in order to query the data base. Row 4 shows the entry of a single key (time=215) retrieval request followed by a two key search (temperature=163 and flow=3681). After the completion of the two retrieval transactions the user has returned to data insertion mode by pecking the RESTART and INSERT boxes. A further triplet of data values (0450, 139, 4463) is then entered into the data store.

Based upon what has been said above it is possible to summarise the data entry protocols as follows:

A Insertion
< time-value > [T] < temperature-value >[T]
< flow-value > [T]

(B) Retrieval
< search-key > [T] < null-key >[T]
< search-key-1 > [T] < search-key-2 >[T]

in which the variables enclosed in angular brackets represent decimal strings created by character stroking operations and [T] denotes a single peck of the T-box. The software in the host has the responsibility of checking that the sequence of characters that it receives from the hand print terminal actually constitute a valid transaction type — as defined by the above allowed protocols. It dos this by (1) checking that the values are all numeric, and, (2) ensuring that they are all written in their correct places on the data capture document.

When designing algorithms for the software that will reside in the host computer two important tools are often used: state graphs and touch tables. The state graph (shown in figure 6A) reflects the way in which different parts of the software take control as a result of the various symbols written and pecks made by the operator on the surface of the document. As was indicated above, initially, the system resides in the transaction selection state. It passes out of this state only as a result of a peck directed at one of the option boxes in the horizontal menu. It returns to this state only as a result of a RESTART peck or for entry of a new document. The other two major states are insert and retrieve. From either of these states the system can pass into an associated field entry state. This happens as a result of the user writing a decimal digit at an appropriate place on the data capture document. The system remains in field entry mode until the terminate transaction box is touched. A return is then made to the parent insert/retrieve state. This enables the value captured during field entry to be entered into the data base (DB) buffer. The system then returns to field entry mode. Should the context of field entry to be insert, then, if the sum of the T-pecks is a multiple of three, the DB insertion state is visited. This now allows the data base to be updated. Similarly, if the context of field entry is retrieve mode and the sum of the T-pecks is a multiple of two, the DB retrieve node takes control in order to search the data base thereby obtaining the information required by the terminal operator.

The touch table (illustrated in figure 6B) is used to define those areas of the document that the software must respond to when pecked or written on. Essentially, this table consists of a listing of all the names of the fields contained in the document being serviced. Associated with each name there is a series of vaues that define the position (row and column) at which the corresponding field occurs on the data capture form. For example, the INSERT box is positioned in row 1, column 30 of the document; the TEMP table commences in column 12 for each of rows 4 through 15; the T-box starts in column 30 for each of rows 15 and 16. In addition to specifying position data, field widths, data type, transaction type and order of entry may also be specified.

Once the state graph and touch table have been constructed, the formulation of algorithms to service the document becomes a simple matter. Algorithms for this case study are presented in pseudo-code form in figure 7. Getchar is a primitive input routine. When invoked it assigns values to the variables R (row number), C (column number) and A (ASCII value). These values correspond to those sent from the terminal for the last character written on its surface. The wait routine simply halts execution of the program for the period of time specified by its single argument. Isin is a primitive set membership operator that checks whether its left hand operand (an element value) is a member of the set specified as its right hand argument. Thus, the statement A isin [A . . 9] simply checks that the value of A lies in the range defined by the subset of the natural numbers 0 through 9.

In the algorithms presented in figure 7, step 6 is responsible for detecting a valid transaction selection peck. Step 7 then handles data insertion operations while step 8 specifies the actions to be taken in order to service a retrieval request. Notice that during an insertion transaction the order of field entry is dictated by the control software. On the other hand, when the system is operating in retrieval mode the order of field entry is user driven.

Algorithms of the type depicted in figure 7 are easily coded — manually or automatically — into either a high level language (such as BASIC, PASCAL or PL/I) or machine code, depending upon the response time required. We have programmed these algorithms using BASIC and have found them to work quite satisfactorily.

CONCLUSION

Electronic hardware and software technologies can be combined to produce a variety of novel machine interaction devices. These can often be employed to (1) realise many end-user applications of computer systems that might otherwise not be possible, and (2) provide new ways of enabling people to communicate with a computer. The hand print terminal is an example of an intelligent input device that allows human-machine interaction to be conducted through the medium of printed messages or by means of menu selection. In the latter case this is most easily accomplished through the use of pecking operations. Peripherals of this type are likely to offer many attractions to those who prefer not to use a keyboard or keypad device as their mechanism for computer data input. Several terminals of this type are now available commercially. Two examples are cited in the bibliography.

BIBLIOGRAPHY

[1] Image Data Products Limited, 1-4 Portland Square, Bristol BS2 8RR, Technical Specifications for the Image Data Tablet.

[2] Micropad Limited, 10 Whittle Road, Wimbourne, Dorset, BH21 7SD, Technical Specifications for the Micropad Hand Print Terminal.

[3] P G Barker, The Magic of Touch, Interactive Systems Research Group Working Paper, March 1982.

[4] P G Barker, Data Base Interaction Using a Hand Print Terminal, International Journal of Man-Machine Studies, in press, 1982.

[5] K Ikeda, T Yamamura, Y Mitamura, S Fujiwara, Y Tominaga and T Kiyono, On-line Recognition of Hand-Written Characters Utilising Positional and Stroke Vector Sequences, PATTERN RECOGNITION, Volume 13, No. 3, 191-206, 1981.

16 BIT'ers

The trend towards 16 bit machines is now very firmly on and within 12 months the 8 bit micro, certainly in the commercial environment, is going to look as old hat as yesterdays 4 bit models. Does anyone remember 4 bit microprocessors even. At this years ONLINE show at Wembley the ACT Sirius again stole the show although there are now some other excellent 16 bit machines coming onto the market and Sirius could face some stiff competition in the coming months. The Almarc-Vector Graphic 8/16 bit model in particular can run existing 8 Bit CP/M software (software availability is going to remain a big problem for 16 bit machines for another 12 months yet) and 16 bit as it becomes available. In addition it offers a 5 Megabyte Winchester plus 630K of floppy for about the same price as the Sirius. Don't phone me phone David Swain at Almarc.

WRIST COMPUTER

I was looking at the specification for a rather remarkable digital watch the other day: perhaps wrist computer is a better description for this little wonder.

Only 10mm thick it not only has time, day and date, but a stop watch and an alarm which actually speaks to you. In a rather tinny but clear voice it reminds you that you didn't get up the first time the alarm went off, and that you really must get out of bed.

It made me realise how close a genuine home computer, the size of a digital watch really is. The display should be no problem, since alphanumeric displays capable of displaying rows of tiny characters, and even crude graphics already exist on digital watches. The chips themselves are no bigger than your little finger nail, and using CMOS technology (big microprocessor chips are already available in CMOS) a lithium battery should have no problems keeping the thing powered continuously for at least a year.

Only the keyboard is a problem, and this problem could be solved with the advent of voice recognition chips within the next few years. Circuits which are capable of recognising simple Basic computer language instructions, such as *PRINT, INPUT, GOTO, RUN* etc plus alphanumerics and a limited range of file names should present no real problems within the next couple of years. 256 spoken sounds should well cover it, and probably much less. Data files not in main memory could be held on a miniature pocket tape recorder or even a bubble memory pack. Later versions could even dispense with or augment the display with the rather tinny synthetic voice circuit which started off this speculation in the first place.

What would anyone do with a wrist computer?

Well that depends as now on the amount of on-board memory, but since RAM memory prices continue to fall, and capacity increases dramatically, this could be even less of a problem than with present home computers. A wrist computer could have practical applications as a memory aide and portable look-up store. Certainly as a highly sophisticated and intelligent calculator and even to play quiz games on as you drive along. It could even tell you the time.

HOME COMPUTER SALES

This is not meant to appear as gloom doom etc., but I now know of 4 home computer shops who are losing money heavily because sales are so poor. One is discreetly on the market looking for a buyer. Two are being propped up by rich sugar daddies (one of them literally) and the other is in imminent danger of closing down. 4 is too small a sample to draw any real conclusions from I know, but with information I hear at exhibitions and trade shows (all in strict confidence, you understand) it really does seem that the recession is still biting hard. People are not exactly rushing out to buy the latest space invaders with real sound etc. Only Sinclair can do no wrong, and perhaps he is responsible for mopping up the sales which would otherwise have gone to the computer shops. With a reputed population now standing at 400,000 in the UK the ZX81 must be having quite an effect on home computer sales in this country.

MAGNETIC DATA STORAGE

For densities as high as 200,000 bits per inch on a floppy disc the next technological step is likely to be 'Vertical Recording'. With this technique the magnetised areas of the medium are orientated vertically, instead of parallel to the surface. Research is going on in the United States and Europe but instead of catching up from the rear the Japanese, this time are unquestionably in the lead.

It is still not clear just how much density can be achieved through vertical recording techniques and some of the first products will be floppies with a conservative density of 20,000 to 40,000 per inch, compared to about 10,000 per inch today.

However, densities of 80,000 to 100,000 have been demonstrated in the labs and such products could follow quickly, with 200,000 tracks per inch being a follow on.

In the USA, Vertimag may soon be offering 5-megabyte 5 inch floppy discs using vertical recording techniques. It is announced that delivery of the system will be in mid to late 1983 at an expected price of $500 each in quantity, for the drives with discs at $25 each.

It looks like the floppy disc is going to be with us a little longer yet.

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BUILD-IT-YOURSELF

DIMMER CIRCUIT

by Harry Fairhead

Extensions to the range of kits available to the amateur are always to be welcomed so I was pleased to come across the range of kits produced by Velleman, a relative newcomer to the UK market. To retail kits successfully, a manufacturer needs to have as large a market as possible. In the United States there are some very large and highly successful organisations on the electronic kits scene — take Heathkit as a prime example — but in this country we have no real equivalent simply because the market is not big enough. It is therefore particularly heartening to find a European based company — Velleman is a Belgian firm — operating over a number of countries rather than confining itself to a single one.

Being an already established company, Velleman can offer an extensive range of kits and there are fifty items on its recent list which vary in price from under £5 to over £200. They are graded into three levels of difficulty. Those at grade 1 are intended for "the beginner with some soldering experience and the understanding of the external characteristics of the most common components". To assemble those at the next level "demands good soldering experience together with a reasonable knowledge of electronics" while those at difficulty grade 3 are mainly intended for professional use and require "perfect soldering technique".

One of the interests of sending for any technical equipment originating from another country is to read the documentation translated from a foreign language. These kits are no exception — the instructions caused me to smile and chuckle on numerous occasions. The odd usage of English causes you to ponder over some of the instructions but they do make sense if you persevere.

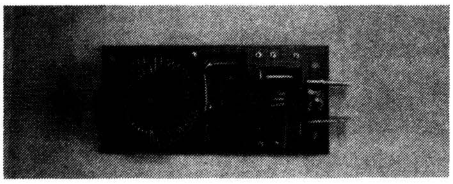
Confining my attention to the amateur kits in the first instance but still faced with a wide choice of kits, ranging from amplifiers to a lighting effects computer, I decided to start by picking one of difficulty grade 1 to discover how those of you less experienced at constructional projects would fare if you sent away for a Velleman kit.

My eye was originally drawn to the Dimmer circuit because of the unfamiliar term "Deparasite" printed in brackets beside it — this turns out simply to mean "suppressed" — but I decided it was a good choice because it is a popular and universally useful one. Most people can find a use for an extra dimmer but as this one can control 1000 Watts its more suitable as a master dimmer for a number of lights, a small electric fire controller or an electric drill speed controller.

Over the years, many designs for thyristor dimmer circuits have been published but because a dimmer circuit involves the mains supply beginners often look for a kit. It means that the quality of the kit is particularly relevant — a mistake could prove FATAL. I was therefore concerned to examine the kit in terms of its ease of assembly and from the point of view of safety. In the instructions the following warning is printed,

"All the parts of the dimmer are at the mains potential and to touch them is extremely dangerous. As this kit was designed for people having some experience in electronics, we presume that people will take all the necessary insulating rules for a safe usage".

Personally, I thought that this warning was a rather poor substitute for spelling out the essential precautions, considering that this kit is in the lowest grade of difficulty.



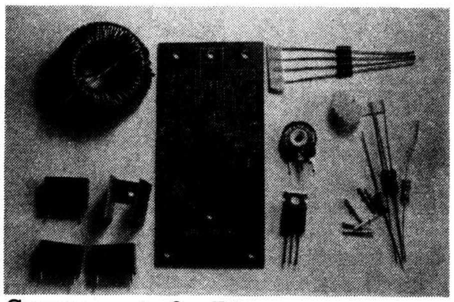
Complete Dimmer Heat Sink.

My kit came with a printed sheet giving instructions in Flemish, French and German and a typewritten sheet giving an English translation. The manufacturers are in the process of preparing new documentation but in any case all the information given currently in the other languages appears to be included in the English sheet — there is one extra piece of information given in English on the printed sheet, namely advice about how to return a non-functioning kit to the manufacturer for attention — but the two kits I've looked at worked perfectly so it is to be hoped that that advice will not need to be followed too often.

The PCB for the dimmer measures 10cms by 5cms and is single sided. All the component positions have been silk screen printed on the top side, making assembly particularly easy. The parts comprise: 1 triac, 4 diodes, 1 diac, 2 condensers, 1 trimmer, 4 resistors, 1 "cooling fin" (i.e. heat sink) and 6 pins — whose purpose is nowhere explained but intended to be inserted into the holes in the PCB where external wires are to be connected. Specific to the "Parasitic" dimmer — which is rather more than twice as expensive as the basic dimmer — is a toroidal coil and an extra condenser which serve to suppress switching noise — rather charmingly translated from the original as "the hysteresis effect". With this number of components even a relatively inexperienced kit builder could expect to complete assembly in a couple of hours or less. Included with the documentation there is a parts identification chart. This is standard to a wide range of kits so components that do not actually occur in the dimmer kit appear on it, which might be just a little misleading. However, the diagrams are particularly clear which make component identification easy. A niggling criticism of the components list was that the colour coding of the various resistors was not included alongside their values in the list — this information is given instead in the section headed "Construction".

The instructions about construction are a simple list of operations with no additional detail to explain each step. There is a rather difficult, and misleading, instruction about the heat sink ("cooling fin"). We are asked to ensure that it does not touch the triac. This is of course quite impossible — for the heat sink to work it must touch the triac — and presumably what the instruction means is that it must not touch the pins of the triac. Moreover, the instructions do not give any guidance as to which way round to mount the heat sink and this is crucial. There is only one way it can be mounted in order not to foul the small variable resistor — the correct way appears to be so that the heat sink hangs over the edge of the board (see photograph).

In the kit I built there appeared to be two missing components. The first was a nut and bolt to hold the heat sink under the triac. Luckily this was easily provided from my tool box. The second was any way of securing the large suppressor coil on the far end of the board. The silk screen diagram indicates a nut that would be tightened to hold it in place. In the absence of any such component the coil hangs on the PCB simply by the two wires which it is connected to. This does not make it inoperable — if the circuit is mounted in a box and is not going to be subject to much movement the loose connections will probably suffice and if a more secure fastening is required, glue or masking tape could be used to secure it.



Components for Dimmer

Velleman do not provide the actual potentiometer to control the output claiming that the range of applications is so great that each user would need to choose either a miniature, a normal 6mm or a slider potentiomenter according to the particular purpose intended. I think that this argument is slightly weak and that they could in fact provide a 1 Mohm standard miniature potentiometer which would suffice for 90 percent of applications. It is a bit frustrating not being able to test the kit once you've built it unless you've had the foresight to purchase a potentiometer.

On the subject of testing it is important to remember that the printed circuit board carries mains voltages that are unbuffered by a transformer. If you make the mistake of holding the circuit in your hand while testing it is unlikely that you will ever build another circuit! To test and use the circuit safely it is important that you mount it in a fully enclosed earthed metal or plastic box. Use a mains supply with a five amp fuse and do not disturb the circuit unless you disconnect it from the supply.

The list price of the 1000 Watt Dimmer is £5.59 and 1000 Watt Dimmer (Deparasite) is £12.64. A complete catalogue is available from Velleman UK., P.O. Box 30, St. Leonards-on-Sea, East Sussex TN3L 7NL.

THE MATHS BOX

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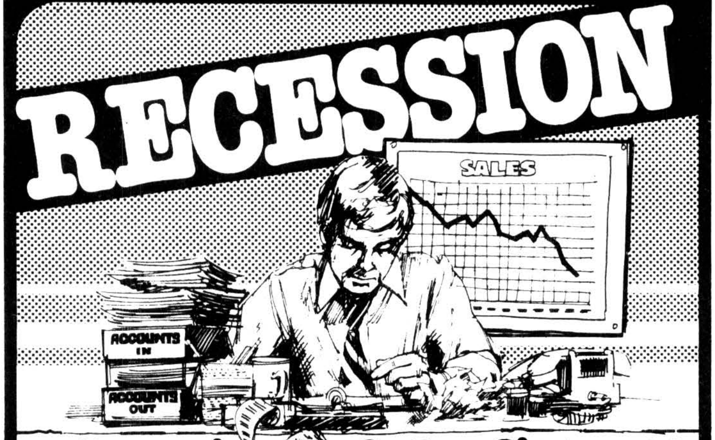

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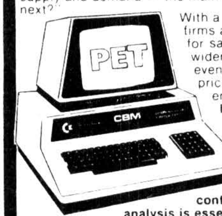

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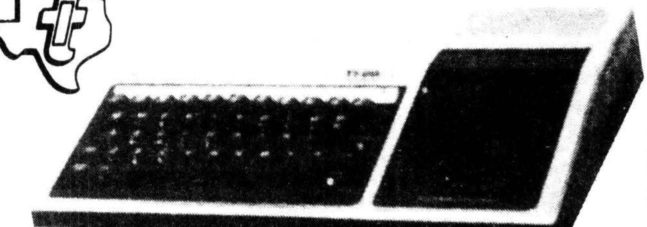

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In May I reviewed a rather dated book concerning computers and amateur radio. Since then I've found a new and well written book on the same topic.

Computers and the Radio Amateur

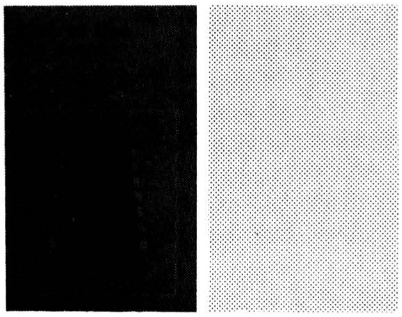
by Phil Anderson, 208 pages, £14.20.
Published by Prentice/Hall International.

This hard-back book was written by Phil Anderson, an American radio amateur — call sign W0X1. It starts off by presenting a very exciting prospect — the computer is seen not only as a Morse code keyer and reader but also for "CW voice", the idea being that you put a speech synthesiser in the computer and transmit codes that cause speech to be output. The last section of Chapter One suggests that the hams' ideal is a completely automated station with CQ search scanning, automatic QSO machines — it almost suggests that you can switch your radio on and leave the computer in charge to carry out the entire exchange! The next few chapters cover a general introduction to computers, programming and logic. Chapter Seven is about interfacing, in particular how to interface amateur radio equipment. It is at this point that Phil Anderson starts to give practical advice and information to actually put into reality some of the ideas presented at the beginning of the book. The remaining five chapters each present a project using the TRS-80. Chapter Eight gives constructional and software details about a computer morse keyer. Chapter Nine complements this by giving a random code generator for morse practice — again complete with program listing. The next chapter demonstrates how the computer can be used as an automatic morse code reader, including a program and hardware details of the interface. Next comes a software project to enable a computer to be used to administrate radio amateur competitions in the U.S.A. Finally there are some fairly standard programs, for example, calculating the size of a dipole, or the number of turns you need on a coil, which give an idea of the ways in which a computer can be used to do standard ham/electronics calculations.

I found the first chapter of the book really exciting but current technology meant that only the less interesting projects could be developed in the practical sections later.

How to Use Op Amps

by E.A. Parr, 154 pages, £2.25.
Published by Bernard Babani.



This is one of the very latest books to be published and is a really worthwhile addition to the electronics bookshelf. It presents a mixture of the theory of operational amplifiers and examples of practical applications which are of interest in themselves and are clearly illustrated with well drawn diagrams. The first two chapters are about theory and basic circuits. Chapters Three to Six are about practical applications including oscillators, audio circuits and filters. Chapter Seven comprises a short but useful reference section of extracts from data sheets about the most commonly occuring op amps. Chapter Eight contains a number of circuits suitable for powering op amps and the final chapter is an extremely short one on fault finding and constructional techniques.

The subject of op amp design is usually dealt with in more theoretical terms by books costing a lot more than this one — so all in all this book is likely to be considered very good value.

STOP PRESS

As the months go by I'm accumulating lots of books I want to tell you about and I've realised that I'll never get to the bottom of the pile if I give them all a proper review. So I'm going to mention a few of the most recent ones briefly and hope that you'll be able to find them in your local bookshops to discover more about them for yourselves.

First on my list is a book by Mike James whose name will be familiar to regular readers of E&C Monthly. It's **"THE 6809 COMPANION"** a reference work that will be invaluable to anyone interested in the 6809 microprocessor, which is becoming increasingly important and popular. The book covers all the topics needed in a machine companion and includes a fully commented instruction set. The chapter on how to convert programs from 6800 code which will be particularly welcomed by anyone upgrading to the 6809 from a 6800. **Published by Bernard Babani,** this book costs **£1.95.**

There are another two recent titles from the same publisher that might interest those of you keen on constructional electronics. The first is **"IC PROJECTS FOR BEGINNERS"** by F.G. Rayer, price **£1.95**, which presents a number of circuits with their stripboard layouts. The second is **"POPULAR ELECTRONICS CIRCUITS BOOK 2"** by **R A PENFOLD,** price **£2.25**, which is a collection ranging from amplifiers and test gear to radios, including over 70 practical circuit diagrams giving component values — no layouts are given.

Among the new titles for the ZX-81 is one that stands out for being extremely nicely produced. It is an introductory volume for the 1K machine with details of how to get the machine up and running as well as plenty of programs. By Ian Stewart and Robin Jones it is entitled **"PEEK, POKE, BYTE & RAM"** and is published by Shiva at **£5.95.** This book takes a very light-hearted approach to the subject but while I was occasionally irritated by the style of the text I was always amused by the cartoons.

THE EXPLORERS GUIDE TO THE ZX81 — Mike Lord Timedata.

This is a well presented and interesting book which is not intended to be a beginners guide to either Basic or the ZX81, but carries on where the ZX81 Basic Manual leaves off.

Chapter 1 is concerned with saving space, other Basics and gives hints on how to use some of the functions of the ZX81.

Chapter 2 contains a range of games and novelty programs. Brief explanations of how the programs work are given and suggestions are made as to how the reader could modify them.

Chapter 3 deals with applications which put the ZX81 to work in a more serious capacity, and gives some useful programs.

Chapter 4 gives an insight into machine language, giving explanations of what it is and its uses. Some programs illustrating machine code are given at the end of the chapter.

Chapter 5 covers the ROM explaining its more important functions, ROM tables, Load and Save, Display and keyboard scanning.

Chapter 6 contains many useful hints on improving the ZX81 hardware, dealing with known problems, and in some cases giving circuits which will overcome them. I did not try all the programs in the book, but those I did try worked.

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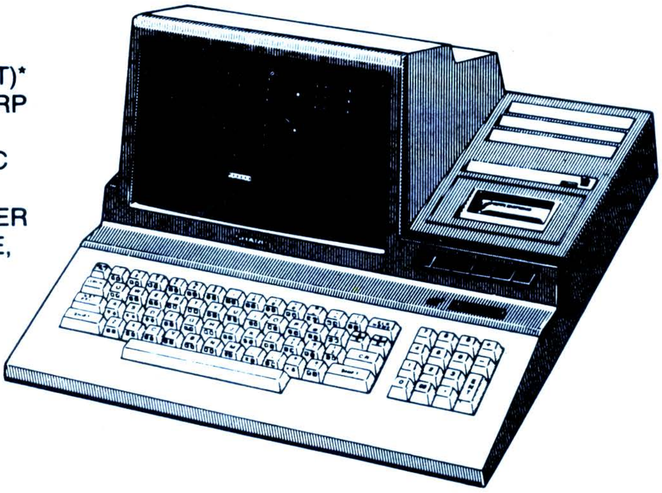

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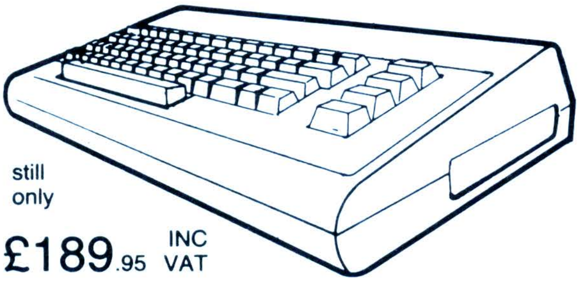

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Key: C = Cassette. D = Disk. E = Cartridge. 2C = 2 Cassettes etc. 8K, 16K etc. shows minimum memory requirement.

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TECHNICAL INFORMATION

- power supply: 220/110V AC 50/60 Hz
- supply current: typ 70mA/220V
  150mA/110V
- 2K byte STATIC RAM STANDARD (expandable to 4K byte)
- microprocessor controlled
- CMOS/TTL LOGIC
- Textool test socket

MECHANICAL SPECIFICATIONS

- length: 420mm
- depth: 190mm
- height: 78mm
- weight 3.75Kg

FUNCTIONS

- blank test
- verify test
- program with automatic blank and verify test
- input or modify data in user RAM at any desired address
- load RAM function to fill the RAM area with data from a preprogrammed PROM to perform a copy
- Parallel load capability from a DMA controlled RAM field
- size selection (16/32K) with single push-button
- OK indication for successful executed functions
- ERROR indication with error codes on display
- blank error
- verify error
- illegal address access error
- increment function which stores the input data via hex. keyboard and jumps to the next address in user RAM
- reset

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OLIVETTI JOIN THE THRONG

This time next year we should be knee deep in 16-bit micros if they continue being launched at the present rate. Olivetti, have announced it will make its entry into the small business and personal computer markets this year with its model M20, 16-bit, Z8001 based computer. This will provide 128K of RAM and one or two built-in mini floppies. The price of the machine is expected to be around 3000 dollars in the USA where it is initially being launched.

Third Commodore Computer Show

The third Commodore computer show will be held at the Cunard Hotel, Hammersmith, London between 3rd and 5th June 1982. It will be their biggest to date with over 100 exhibitors and is expected to attract 20,000 visitors. A complete range of Commodore's new machines will be on display including the Ultimax, Vic 40, Commodore 64 and the CBM 128 and 256 machines. These new products should add a bit of fuel to the already fired-up 16 bit computer market, plus making the choice of buying a personal computer in 1982 that much more difficult.

Information technology awareness programme

This is the first in a series of articles covering the Information Technology Awareness Program which is designed to run for three or four years. The first year coincides with Information Technology Year. This is being organised via the efforts of IT82 Ltd. which is jointly funded by the Department of Industry. This program is intended to increase the awareness of new technology, in particular that associated with the recording, access and use of information. There has been defined three basic target populations with objectives of:

1. Increasing efficiency by full utilisation of new technology, i.e. incorporating micro chips into more products. Closely akin to this is the use of microprocessors in industry. This is still of great interest to the DOI as indicated by their Microprocessor Application Project.
2. Causing people in design and creative areas to look at new ways to use micro chips and to evolve new industries around them.
3. Bringing more information to the general public and improving their access to this information. (Teletext and Prestel for example).

Various events; exhibitions, competitions etc. are being organised to support IT. This column will be giving further information about the project and events over the next few months.

E Midlands Inter-County Schools Business Competition

Five schools from each East Midlands County (Notts. Derbys. Lincs. Leics. Northants.) are being invited to participate in a business competition. A postal competition will decide the county champions who will each receive a prize of a prestel adaptor donated.

$1 Billion Investment Japanese Gear up for Mass Production

Luton, England . . . Japan's Top 20 semiconductor manufacturers invested a staggering $1 billion on new semiconductor plant and equipment in 1981, and are poised to spend the same amount again in 1982 as the Japanese industry gears up for mass production of VLSI devices, claims a report now available from Mackintosh.

The report, 'Semiconductor/Microelectronics Industry in Japan' reveals that, collectively, Japan's Top 20 semiconductor manufacturers are spending 20% of their annual sales value on investment in production facilities alone, excluding Reasearch and Development expenditure.

The cost of setting up a typical LSI production line with a monthly output of 1 million units of 16K bit memory is approximately $18.4 million. This sum, states the report, is approximately half the cost required to set up a similar production line manufacturing 64K bit memory, which it claims the Japanese industry will commence mass production in 1982.

The market leader, NEC, is steadily increasing its investment in production capacity; investment accounted for 24% of semiconductor sales in 1981, compared with 22% in 1980 and 19% in 1979. Other manufacturers are taking even bigger gambles, with Oki Electric, ranked 11th largest manufacturer in Japan, spending a colossal 62% of its semiconductor sales revenue on capital expenditure in 1981, valued at over $63 million. Fujitsu spent over 44% of its semiconductor revenues on investment in 1981, Sharp 35% and Sony 55% (but for these three, 40-50% of output is for internal use).

US suppliers are also announcing firm plans to join Texas Instruments, the only foreign manufacturer in Japan, with both Intel and Motorola expected to be in full production after 1983 and IBM will also have its own internal facility from 1983, currently being constructed at its main Yasu plant.

With regard to overall growth of output Japanese production of Integrated Circuits is expected to expand at 12% per annum 1981-6, compared with 29% per annum between 1976-81, when growth rates were higher starting from a much lower base level. Total Japanese IC output (excluding Hybrids) in 1981 was approximately $3bn, and is expected to rise to $5.2bn in 1986, when the overall Semiconductor Industry (Discretes + ICs + Hybrids) will produce some $8.3bn worth of devices, compared with $5bn in 1981, at an average annual growth rate of 10.5%.

'Semiconductor / Microelectronics Industry in Japan' has been prepared by Yano Economic Research Institute Co. Ltd., Tokyo and comprises 217 pages, over 100 exhibits, size 280mm x 210mm and is available from Mackintosh Publications Limited, Luton.